

**A
FOREST
INDUSTRY
PROCESSING & MARKETING
COMPLEX**
for
Eastern
Kentucky

U.S. DEPARTMENT of COMMERCE
Area Redevelopment Administration



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A FOREST INDUSTRY PROCESSING AND MARKETING COMPLEX FOR EASTERN KENTUCKY

U.S. DEPARTMENT OF COMMERCE

Area Redevelopment Administration

Washington, D.C. 20230



April 1963

FOREWORD

Many areas designated eligible to participate in the Area Redevelopment program are characterized by abundant forests. In most of these areas this great natural resource has not been exploited to the fullest economic potential because of a lack of modern facilities for processing and marketing.

This report deals with this subject as it pertains to eastern Kentucky; however, it also contains a wealth of information and methodology of value to any community which intends to explore the potentials of its own forest resources.

This report was prepared for the Area Redevelopment Administration under Contract No. Cc-5888 by Macdonald Associates, Inc., Washington, D.C. The findings, conclusions and recommendations contained herein are those of Macdonald Associates, Inc.

William L. Batt, Jr., Administrator
Area Redevelopment Administration

INTRODUCTION

This report presents the findings of extensive studies concerned with the function and design of a wood processing and marketing complex recommended for eastern Kentucky.

Background investigations show a substantial forest resource of usable wood species and companion assets of a satisfactory labor supply, an acceptable physical environment, and proximity to concentrated markets. A condition of restricted activity in the manufacture of wood products was evident throughout the region, confirming the observation that only minor advantage is being taken of existing opportunities to develop the region into a basic source of processed wood products. Despite the influence of numerous restrictive conditions there is reason to believe that these can be adjusted, or adjusted to, so that their influence will be minimized.

The objectives of this study have been: (1) to design a business organization able to provide itself with necessary wood raw material and to process that material into finished products; (2) to determine products suited to the available wood resources; (3) to recommend economic means of product manufacture; and (4) to make a reliable projection of the market opportunity available to each product. The fulfillment of these objectives has entailed considerable analysis of each facet of the proposed business venture and has made desirable the recommendation of operating concepts that are not common to the hardwood processing industry.

As a first consideration, the complex should function as an integrated operation commencing with the regional forest resources; therefore, it must be vitally concerned with forest land ownership and forest management programs. Second, the methods of logging and the transportation of logs from the forest to the place of processing must be made highly efficient. As an example, important cost benefits can be gained by transporting tree-length logs from the woods to the manufacturing location instead of following the customary practice of bucking logs to length at the place of felling. Third, although the conversion of logs into various products can follow conventional procedures, the use of mechanized and automated machinery should be applied to the extent of achieving maximum economies of performance. Finally, assuming the economic manufacture of a line of quality products,

the corporate complex should be able to market such products through its own sales organization and do so with a degree of expertness that will assure a profitable growth enterprise.

The operational goal of the complex will be to utilize within itself or through affiliated operations all material derived from sawmill conversion of logs. This means that while the complex will sell lumber internally, it will not ordinarily manufacture lumber for sale on the open market. Ideally, it will engage in purchasing lumber from local sawmills to augment its own capacity. Local purchasing for this purpose can be expected to strengthen community and business relationships and to result in tapping timber resources that might otherwise be unavailable. In addition to using lumber as a product base, a quantity of cordwood will be consumed in the production of flakeboard and other fiber based products.

The diversified manufacturing capability recommended in this report is based on an approach to wood products manufacture that requires efficient conversion of as much of each growing tree as is possible into saleable products. The integrated operation proposed herein, beginning with management of the growing forest and extending through harvesting, processing and—ultimately—to marketing, represents a radical departure from the manner in which the wood industry has customarily operated in Kentucky and adjacent areas. Usually a wood products firm will not concern itself with more than one, or at the most two of these functions, and will confine its manufacturing activity to a limited variety of products.

The device of a wood processing complex is not new to the wood industry; there are several examples of corporations located in other parts of the country that have changed their operating approach to assume the characteristics of a processing complex as outlined by this report. In instances in which adequate management talent, planning, and financing have been directed into such undertakings, the resulting business activity has been rewarding. An historical review shows that when failures have occurred, the cause is usually traceable to unimaginative consideration of one or more of these vital administrative functions. Therefore, efforts to organize a processing

complex in eastern Kentucky must give careful consideration to these needs; and the scale of the enterprise must be large enough to make its activities effective throughout its natural market area.

Markets and the market approach are the ultimate determinants of the practicability of a manufacturing enterprise. Literally thousands of products could be made from the wood resources that are available in eastern Kentucky; but, lacking buyers, there would be no purpose in making them on industrial scale. For this reason, the present market for wood products has been examined carefully. As a result, each product recommended in this report has been

subjected to a rigorous evaluation that has served to verify its market acceptance and its ability to meet competitive sales criteria.

It is intended that this report will serve as a guide to the preparation of a formal corporate prospectus. To this end, the content has been developed in a manner that will permit it to be used as a reference in support of such a prospectus. Because of this, flow diagrams, cost estimates, and economic projections have been developed with accurate detail. Recommended equipment and projected costs are based on today's market and, in many instances, reflect quotations and recommendations prepared by various machinery manufacturers.

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Section I

Industry Environment in Eastern Kentucky

Characteristics of the Economy

The economy of Kentucky is based on manufacturing, trade and agriculture which in 1960 engaged, respectively, 21.3 percent, 17.3 percent, and 14.2 percent of all employed persons. Setbacks and readjustments in the economy over the past few years caused unemployment in the State to reach 6 percent in 1960, with pockets of unemployment in some counties reaching to 20 percent or more of the work force. In 1961 unemployment insurance payments for the State amounted to \$38,655,777, and other forms of public assistance reached the figure of \$62,698,030. The median family income for Kentucky in 1960 was \$4051, and 38 percent of all families had incomes of less than \$3000.

While few counties of the State have been spared, the most acute situation with respect to unemployment is to be found in the Eastern Highlands, where rapid automation of mining operations has reduced the demand for labor and where farming, trade, and manufacturing are at a low level compared to the rest of the State. Table I-I, below, illustrates the comparison in unemployment and family incomes for the 36 counties included in the eastern Kentucky redevelopment region.

Although the internal composition of the economy in eastern Kentucky resembles that of the State as a whole, for many categories of industry significant differences are apparent. Mining accounts for only 4 percent of all employed persons in the State; in eastern

Kentucky, by contrast, it accounts for 16.5 percent of all employment. In 1960, approximately 26,500 mining employees in this region represented 71 percent of all such employees in the State. Similarly, eastern Kentucky accounts for 48.8 percent of all persons in the State engaged in forestry and fishing. By contrast, only 9.4 percent of all employees in manufacturing industries in Kentucky are employed in eastern Kentucky. While 21.3 percent of all employees in Kentucky are engaged in manufacturing industries, only about 11.5 percent of the labor force in eastern Kentucky is so engaged. The proportion of persons engaged in professional services (medical services, social services, and education) is slightly higher in eastern Kentucky than in the rest of the State.

The picture that emerges is one of an economy dominated by mining, trade, and agriculture but with some important manufacturing activity. Business and personal services are at a slightly lower level than for the entire State, while the proportion of employees in the fields of finance, insurance, and real estate is 60 percent lower. The last two factors tend to confirm the relatively elementary level of business activity observed in the course of extensive field investigations and, furthermore, suggest a rigidity in the economy which has retarded internal expansion and reorientation because of a lack of business skills. Table I-II summarizes the pertinent data for the 36 eastern Kentucky counties and provides comparative data for the State as a whole.

The relationship between mining and manufacturing in eastern Kentucky as of 1960 by reference to the work force engaged in these two industries is shown on Map I-I. The map presents a county by county analysis of the region which indicates that the manufacturing work force is concentrated along the western edge of the region. With some major exceptions, manufacturing in these counties consists of processing agricultural commodities: lumber and wood products, food processing, and textiles and related industries. Primary metal production and chemicals are important in Greenup County, in the northeast, while some machinery industries are located in the triangle formed by Madison,

TABLE I-I
UNEMPLOYMENT AND MEDIAN INCOME, 1960

	Entire State	Eastern Kentucky	County Range - Eastern Kentucky
Unemployed (per cent)	6.0	9.6	3.6-21.3
Median family income (dollars)	4,051	2,263	1,324-4,393
Family incomes less than \$3000 (per cent)	38.0	62.7	33.2-80.8
Family incomes more than \$10,000 (per cent)	8.0	3.8	0.7-5.7

Source: U. S. Census, 1960

Estill, and Powell counties. The southeastern sector of the region is dominated by a coal mining economy. Manufacturing industry in this area retains the same pattern suggested above: lumbering and wood products, food processing, and some textiles and clothing.

The relative importance of lumber, furniture, and other wood products among the manufacturing industries is confirmed by the fact that this phase of industry employed 5421 workers in 1960 and represented 29 percent of all manufacturing activity in eastern Kentucky. More significantly, the employees in these eastern Kentucky industries represented about one-third of all such employees in the State. A more detailed discussion of the lumber and wood products industry is presented at the end of this section.

In general terms, the level of indigenous business activity in the region of eastern Kentucky is below that of the rest of the State and inadequate to support large scale industry. Business enterprises are typically sole proprietorships or closed corporations, and credit is tightly controlled by conservative banking policies. Even where a bank adopts a liberal policy to encourage new business activity, the financial resources of the region are limited. Total bank deposits, including

governmental deposits, in the region were about \$2.1 billion in 1960, or about 12 percent of the total bank deposits in the State. The population of the region, on the other hand, is about 22 percent of the State. Any large scale development of the region, therefore, must rely on the introduction of outside capital, preferably on long-term loan. Because of the difficult situation in other parts of the State and the competition for limited capital resources, however, most of this capital must come from such sources as the Area Redevelopment Administration, the Small Business Administration, and State industrial development funds.

Labor and Management

Labor Force

Eastern Kentucky is a labor surplus area, a fact attributed in part to the recent automation of coal mines in the area and in part to a relatively high birth rate. In 1961, the Kentucky Department of Economic Development estimated that about 36,000 men and 44,000 women were available for employment in the region. The majority of these unemployed workers, however, are unskilled and

MAP I-1

DISTRIBUTION OF WORK FORCE IN MINING AND MANUFACTURING

1960

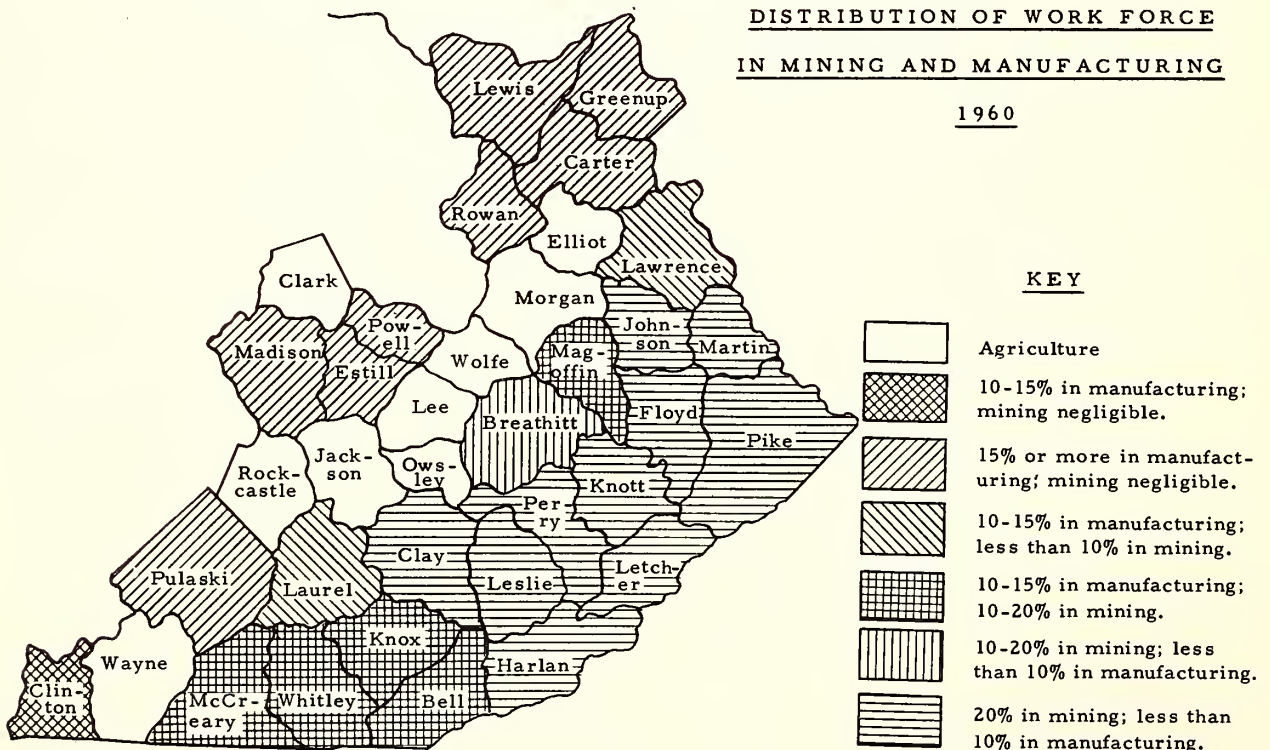


TABLE 1-II
SELECTED DATA FOR EASTERN KENTUCKY COUNTIES

County	Population 1960			Land Area in Square Miles 1960	Personal Income 1957		Average Monthly Employment* 1960	Total Payrolls* 1960 (000)
	Total	Urban	Rural		Total (000)	Per Capita		
Bell	35,336	15,788	19,548	370	\$ 32,217	\$ 903	3,625	\$ 12,165
Breathitt	15,490	0	15,490	497	11,236	626	546	2,458
Carter	20,817	0	20,817	402	17,493	888	1,923	6,688
Clark	21,075	10,187	10,888	259	29,337	1,384	3,524	13,126
Clay	20,748	0	20,748	474	12,801	528	1,699	4,004
Clinton	8,886	0	8,886	191	5,977	645	528	1,043
Ellicott	6,330	0	6,330	240	3,525	581	85	230
Estill	12,466	2,955	9,511	260	9,249	691	566	1,557
Floyd	41,642	3,133	38,509	401	41,973	961	5,142	20,809
Greenup	29,238	8,257	20,981	350	16,260	536	739	3,101
Harlan	51,107	12,258	38,849	469	84,137	1,599	6,769	29,304
Jackson	10,677	0	10,677	337	6,230	497	284	757
Johnson	19,748	4,025	15,723	264	17,268	767	1,499	4,088
Knott	17,362	0	17,362	356	6,928	364	458	1,363
Knox	25,258	4,587	20,671	373	12,677	441	856	2,246
Laurel	24,901	4,035	20,866	443	13,150	497	1,734	5,347
Lawrence	12,134	0	12,134	425	12,332	915	552	1,492
Lee	7,420	0	7,420	210	6,436	852	552	1,682
Leslie	10,941	0	10,941	412	9,864	529	1,712	4,079
Letcher	30,102	3,202	26,900	339	30,662	1,054	1,210	13,871
Lewis	13,115	0	13,115	484	8,309	657	585	1,648
McCreary	12,463	0	12,463	408	7,317	570	543	1,611
Madison	33,482	16,470	17,012	446	39,148	1,138	3,403	10,454
Magoffin	11,165	0	11,165	303	6,403	621	354	1,062

in the higher ages, 40 to 60. Large numbers of younger men and women, in the 18-39 year age groups, many of them with skills acquired by means of attendance at the excellent vocational schools in the area, have left eastern Kentucky to find work in industrial centers in Kentucky and nearby states.

The following table suggests the impact of out-migration on the population of the 30-county area of eastern Kentucky for which comparative data were available:

Period	Population at Beginning of Period	Population at End of Period	Net Change	% Change
1940-1950	768,486	740,269	28,217	-3.7
1950-1960	740,269	610,133	130,236	-17.6

A study by the Kentucky Department of Economic Development estimated that 101,148 males and 97,848 females in eastern Kentucky would reach the age of 18 during the period 1958-1968, providing that their families did not migrate from the region. Many of these young men and women are receiving excellent training at the secondary

school level and in the several technical and vocational schools in the area. Despite the low family income level in the area, a number of them will attend colleges and universities, either in eastern Kentucky (e.g., the Cumberland branch of the University of Kentucky) or in nearby states. Lacking job prospects, a substantial number of these young people will migrate to areas where their talents and skills can be utilized. The result, of course, is a net loss to the trained labor pool. Far more significant, however, is the cumulative loss in terms of the area's human resources and community leadership. Nevertheless, responsible community leaders feel that many of the displaced workers and young people would return to eastern Kentucky if job prospects improved.

The relatively low level of technical skills among the unemployed labor pool in the region has been considered a deterrent to industrial expansion. However, the consistent demand for the graduates of the Mayo State Vocational Training School at Paintsville by industrial employers in the surrounding states suggest that the Kentucky worker

SELECTED DATA FOR EASTERN KENTUCKY COUNTIES (CONT'D)								
County	Population 1960			Land Area in Square Miles 1960	Personal Income 1957		Average Monthly Employment* 1960	Total Payrolls* 1960 (000)
	Total	Urban	Rural		Total (000)	Per Capita		
Martin	10,201	0	10,201	231	\$ 3,863	\$ 314	278	\$ 688
Morgan	11,056	0	11,056	369	9,846	1,071	634	1,816
Owsley	5,369	0	5,369	197	2,930	457	17	38
Perry	34,961	5,958	29,003	343	40,677	1,110	4,414	17,370
Pike	68,264	4,958	63,510	786	68,464	962	6,264	24,156
Powell	6,674	0	6,674	173	3,783	534	347	924
Pulaski	34,403	10,757	23,646	630	27,881	783	3,141	8,994
Rockcastle	12,334	0	12,334	311	7,234	546	190	446
Rowan	12,808	4,170	8,638	290	10,636	1,121	1,340	3,757
Wayne	14,700	2,940	11,760	440	10,212	634	1,079	2,749
Whitley	25,815	9,221	16,594	458	21,003	729	2,019	5,820
Wolfe	6,534	0	6,534	227	3,339	454	69	128
EASTERN KENTUCKY	735,013	122,697	612,316	13,166	\$ 650,797	\$ 749	60,650	\$ 211,071
% of State	24.2	9.0	36.3	33.0	15.59	54.5	13.5	11.1
KENTUCKY	3,039,156	1,353,215	1,684,941	39,863	\$4,172,000	\$1,372	447,284	\$1,885,319

* Data for industries covered by the Kentucky Unemployment Insurance Law

Source: Deskbook of Kentucky Economic Statistics, 1961, Frankfort, Ky.: Department of Economic Development, 1962

possesses both aptitude to learn skilled trades and a favorable attitude toward work itself. Obviously, a certain amount of retraining will be required for the many unemployed miners of the region before they can contribute effectively to any industrial program.

In addition to the Mayo School at Paintsville, the region has three Area Vocational Schools (at Harlan, Hazard, and Somerset) and access to another at Ashland, just outside the region. Each of these schools provides secondary level and adult extension programs in the fields of carpentry and cabinet making, drafting, machine shop, sheet metal work, welding, and industrial electricity. The area school at Hazard conducts a course in heavy equipment operations and maintenance for adults, while the Mayo school conducts a course in diesel mechanics. Courses in business and commerce are also available within the region.

Wages and Working Conditions

Wages and salaries in eastern Kentucky are generally at the bare minimum except in the unionized coal mines. Wage rates for common labor employed by industries engaged in interstate commerce tend to hover at the minimum of \$1.15 per hour, while even

highly skilled workers usually draw less than \$2.00 per hour. Supervisory and managerial personnel similarly are paid less than the average for U.S. industry as a whole; a typical figure cited for a plant manager is between \$7000 and \$8000. This situation is primarily indicative of the lower living standards prevailing in the region.

While summary wage data are not available for sawmills and planing mills in eastern Kentucky, it is instructive to examine the average hourly wages in comparable manufacturing activities in 132 plants located in nearby states, shown by Table I-III. The average for all production workers in these plants in June 1962 was about \$1.27 per hour (straight time); maximum wages of \$3.30 per hour were paid to band mill headsaw operators in one state. The highest wages, in most instances, were paid in Tennessee, while Virginia's wage spread is relatively narrow.

Table I-III shows only straight hourly wages and not work conditions. By far the largest number of workers (82-95%) in the plants surveyed worked 40-hour weeks. Where second or third shifts were worked, shift differential pay was seldom paid. Paid holidays were reported for about 38 percent of all workers in Tennessee, but about 87 percent of workers in Virginia and North

SELECTED DATA FOR EASTERN KENTUCKY COUNTIES (CONT'D)

County	Retail Sales* 1958 (000)	Value of Mineral Production (1959)	Total Bank Deposits* June 15, 1960 (000)	Manufacturing, 1958			
				No. of Estab.	Number	Payroll (000)	Value Added by Manufacture (000)
Bell	\$ 25,129	\$ 4,371,487	\$ 13,103	33	650	\$ 2,206	\$ 4,599
Breathitt	5,420	4,963,817	3,110	9	41	85	134
Carter	11,600	1,457,377	9,948	18	748	2,851	5,302
Clark	21,640	**	22,094	18	1,115	3,491	7,947
Clay	7,605	4,219,978	4,701	20	173	295	586
Clinton	4,773	**	2,990	10	194	395	518
Elliott	1,551	375,338	1,075	2	**	**	**
Estill	5,785	412,286	4,143	18	316	809	1,094
Floyd	19,926	**	17,452	16	81	315	311
Greenup	10,722	**	6,993	15	251	1,134	2,314
Harlan	34,014	**	16,204	24	445	1,439	2,436
Jackson	3,232	**	3,431	8	32	41	65
Johnson	12,844	1,455,817	8,987	12	104	160	267
Knott	3,594	3,496,111	2,363	6	17	15	32
Knox	9,189	353,512	4,684	21	320	698	1,555
Laurel	16,352	1,364,529	11,630	27	408	1,264	2,766
Lawrence	5,384	1,001,792	3,866	10	43	97	219
Lee	3,209	**	2,902	5	24	**	**
Leslie	4,442	12,051,780	1,688	17	206	439	828
Letcher	14,779	**	8,608	13	129	399	841
Lewis	5,245	0	3,716	16	342	**	**
McCreary	5,303	2,129,026	2,298	14	59	97	120
Madison	29,111	**	20,020	22	853	3,021	8,178
Magoffin	3,021	4,468,218	2,184	3	12	**	**

Carolina received no holiday pay. In Tennessee, about 44 percent of the employees surveyed were provided paid vacations (usually one week after one year of service and two weeks after five years of service). Only about 20 percent of the employees in Virginia and North Carolina were provided paid vacations, seldom exceeding one week regardless of length of service. Group health and accident insurance plans were provided only 19 percent of surveyed production employees in Virginia. In North Carolina and Tennessee, however, more than 40 percent of the production employees were provided some form of health and accident insurance. None of the 132 plants surveyed had any form of retirement plan for its employees.

Detailed wage data for other wood products industries are not available for eastern Kentucky, but comparable data from several nearby furniture manufacturing areas are illustrative, insofar as the occupations are the same as many of those contemplated for the wood products complex and its satellite

operations discussed in this report. The detailed data are shown by Table I-V for plants employing 20 or more in the Winston-Salem-High Point and Hickory-Statesville areas of North Carolina, Indiana, and Martinsville, Virginia. It is worth noting average hourly wages for the southern furniture areas compared to those prevailing at Grand Rapids, Michigan, Indiana, and Jamestown, New York:

The significantly higher costs paid in the furniture industries of Indiana, Michigan, and New York suggest a favorable market for such items as dimension stock and furniture frames produced in areas where costs are relatively low, despite shipping charges incurred.

Fringe benefits in the wood furniture industry are somewhat more attractive than those in logging and sawmilling. While additional wages are seldom paid for second and third shifts, all workers surveyed in Martinsville, Virginia, and most workers in the North Carolina areas are covered by life insurance and some form of health and accident in-

SELECTED DATA FOR EASTERN KENTUCKY COUNTIES (CONT'D)

County	Retail Sales 1958 (000)	Value of Mineral Production 1959	Total Bank Deposits* June 15, 1960 (000)	Manufacturing, 1958			
				No. of Estab.	Number	Payroll (000)	Value Added by Manufacture (000)
Martin	\$ 2,578	\$ 251,642	\$ 1,886	2	**	\$ **	\$ **
Morgan	5,513	**	4,384	5	72	152	17
Owsley	1,330	156,079	1,064	4	13	15	7
Perry	23,772	18,858,574	9,036	10	132	357	544
Pike	32,339	**	29,289	37	350	1,018	1,244
Powell	1,883	**	2,206	8	62	118	206
Pulaski	22,353	**	19,176	49	1,134	2,982	6,076
Rockcastle	5,239	**	2,858	5	24	26	35
Rowan	8,581	350,701	7,332	24	559	1,549	2,820
Wayne	6,817	**	5,133	19	486	1,045	1,635
Whitley	18,997	**	16,074	29	377	999	1,372
Wolfe	1,367	205,980	1,202	4	27	30	32
EASTERN KENTUCKY	\$ 394,639	\$ 61,944,044	\$ 277,830	553	9,799	\$ 27,542	\$ 54,110
% of State	15.2	14.8	13.1	19.3	6.2	3.9	3.0
Kentucky	\$ 2,580,517	\$ 416,391,000	\$ 2,115,512	2,851	157,754	\$ 693,174	\$ 1,781,969

* Includes interbank and government deposits.

** Withheld to avoid disclosing data for individual companies.

Source: Deskbook of Kentucky Economic Statistics, 1961, Frankfort, Ky.: Department of Economic Development, 1962.

insurance. Most workers received some paid holidays and a week's vacation with pay after one year of service.

Although it can be assumed that, as a general rule, hourly wages in eastern Kentucky wood products industries will approximate those in nearby southern states, it should be noted that manufacturing wages in Louisville, where a number of wood product plants are located, are significantly higher. A 1962 wage survey in this area showed that some of the same occupational groups required for the wood processing complex receive up to 120 percent more in hourly wages. Some of these data for Louisville are shown by Table I-VI, compared to prevailing rates already tabulated. The table does not permit a comparison of wage rates for sawyers, planing mill operators, or other specially trained personnel; but, judging from the available data, wages for these occupations should now be significantly higher in Louisville than in eastern Kentucky.

While one of the conclusions of this study is that sufficient numbers of workers can be recruited to support the industrial program proposed by this report, it seems apparent that internal and external pressures will tend to force the prevailing industrial wage

toward national averages. The need to deter the flight of skilled labor, and the necessity to provide real wages to unskilled laborers sufficient to enable them to improve their own standard of living will contribute to increased wage rates in the future.

Management Skills

A more serious problem is the lack of technological and management skills required for sophisticated industrial operations, particularly for entrance into the field of wood products. In most cases, technological know-how must be sought outside the state within the existing wood products industry, at least for the immediate future. At a later date, special educational programs could be instituted at such centers as Morehead State College (Morehead), the University of Kentucky branch at Cumberland, or any of the numerous private junior colleges and colleges in the area that are now training east Kentucky youths for employment outside the State. The emphasis intended is not on forestry—plans for a forestry school are well-advanced—but on business management, industrial engineering, corpo-

TABLE I-III
AVERAGE STRAIGHT-TIME HOURLY EARNINGS
SAWMILLS AND PLANING MILLS, 1962

OCCUPATION	Va.	Tenn.	N. Car.	Area Max.
<u>All Production Workers</u>	\$1.26	\$1.29	\$1.26	\$2.60+
<u>Sawmill and Planer Operations</u>				
Block Setters	\$1.29	\$1.20	\$1.25	\$1.70
Cut-off Saw Operators	1.19	1.21	1.16	1.80
Edgemen	1.25	1.22	1.18	2.00
Firemen, stationary boiler	1.16	1.23	1.14	1.60
Graders, lumber (green chain)	1.30	1.87	1.31	2.60
Graders, planed lumber	1.36	1.57	1.35	2.70
Headsaw Operators (bandsaw)	--	2.14	2.17	2.30
Headsaw Operators (circular saw)	1.86	1.56	1.70	2.60
Janitors, porters and cleaners	1.16	1.19	1.14	1.45
Loaders, car and truck	1.16	1.18	1.16	1.45
Log Deckmen	1.17	1.16	1.18	1.60
Lumber Stackers	1.16	1.22	1.20	2.10
Off-Bearers, machine	1.16	1.17	1.16	1.60
Planer Operators (feed only)	1.17	1.25	1.22	1.80
Planer Operators (setup and operate)	1.36	1.40	1.62	2.70
Sorters, green chain	1.16	1.25	1.14	1.60
Trimmermen	1.19	1.20	1.18	1.55
Truck Drivers	1.22	1.25	1.19	1.90
Truckers, power (fork lift)	1.24	1.29	1.22	1.85
Watchmen	1.16	1.20	1.13	1.45
<u>Logging Operations</u>				
Cat Drivers, skidding	\$1.26	\$1.22	\$1.31	\$1.80
Chokermen	1.25	--	1.16	1.45
Fallers and Buckers, power	1.24	1.23	1.22	1.70
Ground Loaders	1.16	--	1.17	1.35
Teamsters, logging	1.19	1.18	1.18	1.60
Truck Drivers, logging	1.26	1.20	1.15	1.55

SOURCE: Bureau of Labor Statistics, U. S. Department of Labor, based on the June 1962 payroll period.

rate finance, and marketing. For the immediate future, however, on-the-job training and such extension programs as can be presented by the Quick Sand facility of the University of Kentucky must be relied upon to develop the next lower levels of supervisors and prepare them for future responsibilities. In this connection the planned Wood Use Demonstration Center at Quick Sand is designed to play a major role in the rapid development of technological skills in the forest product industry.

The recruitment and training of upper-level supervisory personnel will be a major problem for any new large scale industry established in eastern Kentucky. The current level of business management experience is relatively low, largely because of the rather elementary level of business activity in the area. Although plant managers can probably be recruited outside the State, a desirable training device would be to assign a resident trainee as an assistant to each such manager. These assistants should probably have a general mechanical or industrial engineering background; the complex could profitably adopt a policy to pay

TABLE I-IV AVERAGE PRODUCTION WAGES IN SELECTED WOOD HOUSEHOLD FURNITURE MANUFACTURING AREAS, 1962				
MANUFACTURING AREA	Workers Surveyed	Average Straight-Time Wages per Hour		Maximum (Men)
		Men	Women	
Winston Salem-High Point, N.C.	88%	\$1.38	\$1.24	\$2.50
Hickory-Statesville, N. C.	68	1.39	1.23	2.30
Martinsville, Va.	70	1.36	1.17	2.30
Indiana	73	1.71	1.46	3.70
Grand Rapids, Michigan	85	1.90	1.57	2.90
Jamestown, N. Y.	74	1.94	1.62	3.00+

for attendance of these trainees at special management courses in local educational institutions and at industry seminars, trade association conventions, and technical society meetings. These trainees will be prepared to move up the scale in managerial responsibility after a period of three to five years to relieve "imported" managers (who will probably move on) or to set up new or enlarged processing operations.

The overall management of the corporation outlined in this report will also require the relatively scarce skills of corporation finance experts, corporation lawyers, sales managers,

TABLE I-V
WAGES IN SELECTED OCCUPATIONS IN SOUTHERN
WOOD FURNITURE MANUFACTURING AREAS, 1962

OCCUPATIONAL GROUP	MANUFACTURING AREA AND STRAIGHT-TIME HOURLY WAGES					
	Winston Salem-High Point		Hickory-Statesville		Martinsville	
	Avg/hr	Max/hr	Avg/hr	Max/hr	Avg/hr	Max/hr
<u>Production Workers (Male Only)</u>						
Cut-off saw operators	\$1.45	\$1.80	\$1.51	\$2.10	\$1.50	\$1.70
Gluers, rough stock	1.31	1.75	1.37	1.80	1.30	1.75
Maintenance man, general utility	1.74	2.30	1.53	2.40	1.68	2.20
Off-bearers, machine	1.23	1.55	1.22	1.65	1.21	1.50
Packers	1.32	1.65	1.28	1.65	1.23	1.65
Planer operators (setup & operate)	1.44	1.70	1.47	2.00	1.58	1.70
Planer operators (feed only)	1.24	1.50	1.27	1.50	1.37	1.60
Rip-saw operators	1.43	1.75	1.44	1.80	1.49	1.70
Sanders, machine, belt	1.45	1.80	1.50	2.10	1.47	1.75
Shaper operators, automatic (setup & operate)	1.52	1.75	1.68	2.00	1.69	1.90
<u>Office Occupations (Females Only)</u>						
Clerks, payroll	\$1.56	\$1.90	\$1.78	\$2.20	\$1.66	\$2.20
Stenographers, general	1.41	2.30	1.51	1.75	1.53	1.90
Stenographers, senior	--	--	2.19	2.40	1.85	2.30

Source: Bureau of Labor Statistics, U. S. Department of Labor, based on July 1962 payroll period.

management consultants, and others not readily available in eastern Kentucky. Some of these can be recruited for specific executive positions—with appropriate provisions for training replacements from among resident Eastern Kentuckians; others can be retained on a consulting basis while full-time personnel are trained to fill corporate vacancies.

In the long-run, the recruitment and training measures used will determine the success of the enterprise. The private investors expected to take seats on the board of directors

Transportation

Eastern Kentucky is served by three railroads (Chesapeake and Ohio, Louisville and Nashville, and Southern). Four north-south Federal highways (U.S. Routes 23, 25, 27, and 119) and two Federal east-west highways (U.S. Routes 60 and 460) in the region are connected with a reasonably adequate network of State highways and county secondary roads, as shown by Map I-II. Waterways are only marginally significant in a commercial sense in the interior; but the Big Sandy River on the east is navigable as far as Louisa, the Kentucky River on the west is navigable as far as Beattyville by means of a six-foot barge channel, and the Ohio River forms the northern boundary of the region. Commercial air service is also limited to the fringes of the area. The nearest commercial airfields in Kentucky are located at Lexington and London-Corbin; in the east and southeast, airfields at Bristol, Tennessee, and Huntington, West Virginia, service the area. Small airstrips for private and charter planes are available at Harlan, Middlesboro, Pikeville, and Morehead; these strips are frequently inaccessible because of adverse weather conditions.

The existing transportation network permits only limited through rail and highway traffic, a situation dictated by the fact that roads and railroads follow winding river and creek beds in the interior. In 1958, eastern Kentucky had only about 18 percent of the State's surfaced roads and about half of the State's non-surfaced roads; about 80 percent of the 18,000 miles of roads in the area were unsurfaced or gravel-surfaced. While some improvement has been registered since that time, under the State program of assistance to county highway departments, the road network in the region is still severely limited from the standpoint of industrialization. And, although the State Highway Department will cooperate with county officials in the construction of access roads to serve local industry, the effect of the program is limited by the limited availability of construction funds and a policy of not entering into such a program until the location of new industry is assured.

As might be expected, the heaviest concentration of railroad trackage is in the coal fields in the southeastern sector of the region. As shown by Map I-II, service to the interior counties is relatively limited. Through shipments by rail are generally difficult from interior counties, though it is possible to combine rail shipments with short-

will not necessarily be able to provide the requisite skills required to oversee the operations of the corporation as recommended. It is imperative, therefore, that special attention be paid to early recruitment and training of qualified management personnel in order to satisfy the requirements of institutional investors and such Government agencies as the Small Business Administration and comparable State agencies in Kentucky.

Transportation, Communications, and Utilities

The rugged terrain of eastern Kentucky has discriminated against the development of the expensive modern transportation, communications, and utilities networks required for industrialization on any appreciable scale. Existing facilities tend to be concentrated along the borders of the region or in particular locations—i.e., the coal fields in the southeastern sector.

TABLE I-VI

COMPARATIVE WAGES
LOUISVILLE AND SOUTHERN STATES, 1962

OCCUPATIONAL GROUP	AVERAGE HOURLY WAGES, 1962	
	Manufacturing Louisville	Wood Products Southern States
Firemen, stationary boiler	\$2.59	\$1.18
Janitors and porters	2.09	1.16
Loaders, car and truck	2.20	1.17
Truckdrivers	2.56	1.22
Watchmen	1.76	1.16
Maintenance men	2.99-3.18	1.65
Packers	2.24	1.28
Clerks, payroll (female)	1.94	1.67
Stenographers, general (female)	1.75	1.45
Stenographers, senior (female)	2.11	2.02

KENTUCKY

TRANSPORTATION MAP

MAP I-II

OPERATING RAILROADS

B&O	Baltimore & Ohio
C&O	Chesapeake & Ohio
CA	Carrollton
C&D	Cadiz
CB&Q	Chicago, Burlington & Quincy *
C&I	Chicago, Indianapolis & Louisville *
CLIN	Cincinnati
CNO&TP	Cincinnati, New Orleans & Texas Pacific (Southern)
F&C	Frankfort & Cincinnati
F&NO	Flemingsburg & Northern
G&MO	Gulf, Mobile & Ohio
IC	Illinois Central
K&T	Kentucky & Tennessee
L&N	Louisville & Nashville
M&N	Morehead & North Fork
N&W	Norfolk & Western
NC&SL	Nashville, Chattanooga & St. Louis
NYC	New York Central *
P&I	Paducah & Illinois
PA	Pennsylvania *
SOU	Southern
TC	Tennessee Central

* Operating only to the borders of KENTUCKY.
All Others operate trackage in the State.

TRACK SYMBOLS

Single Track
Double Track

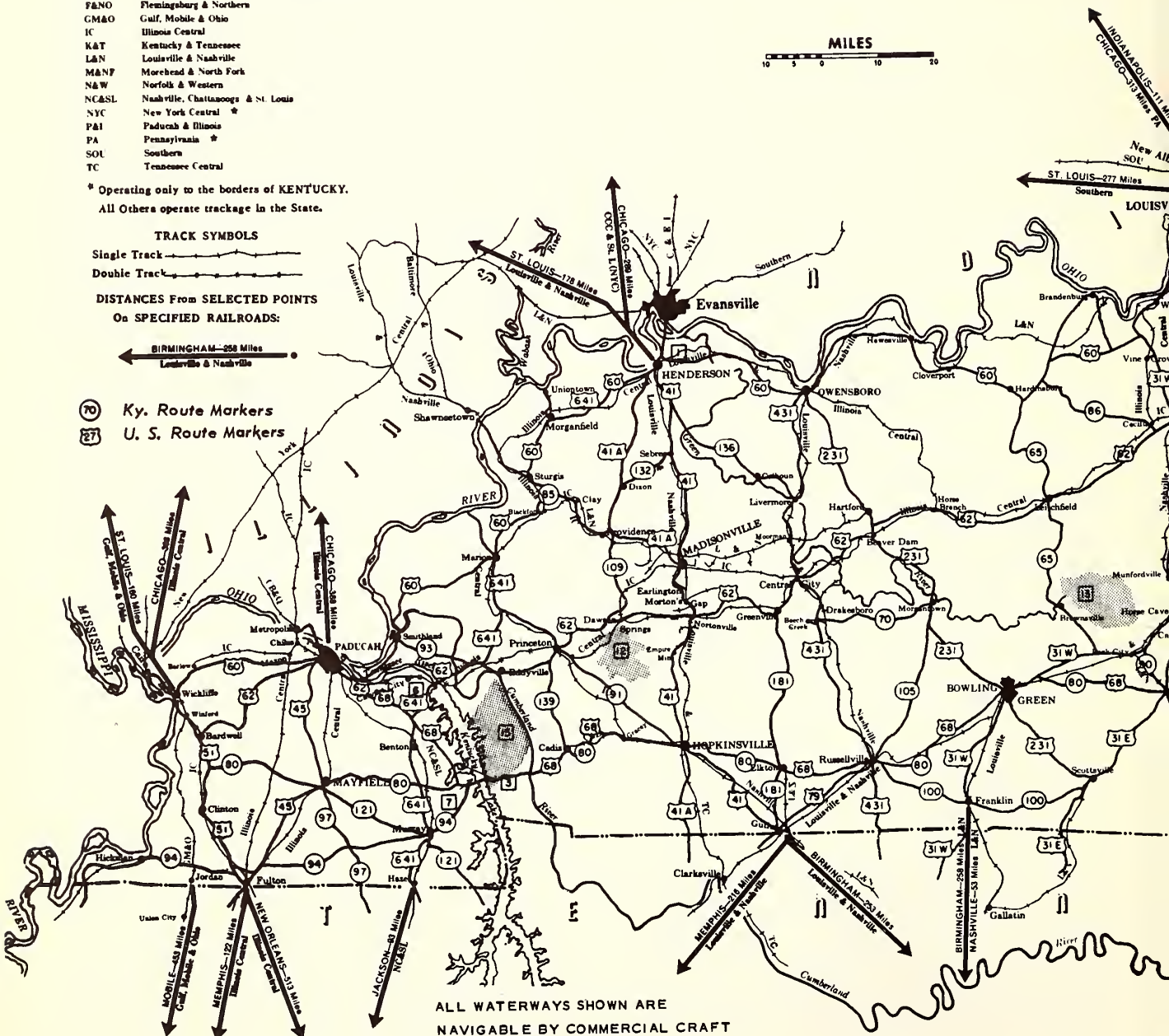
DISTANCES From SELECTED POINTS
On SPECIFIED RAILROADS:

BIRMINGHAM—258 Miles
Louisville & Nashville

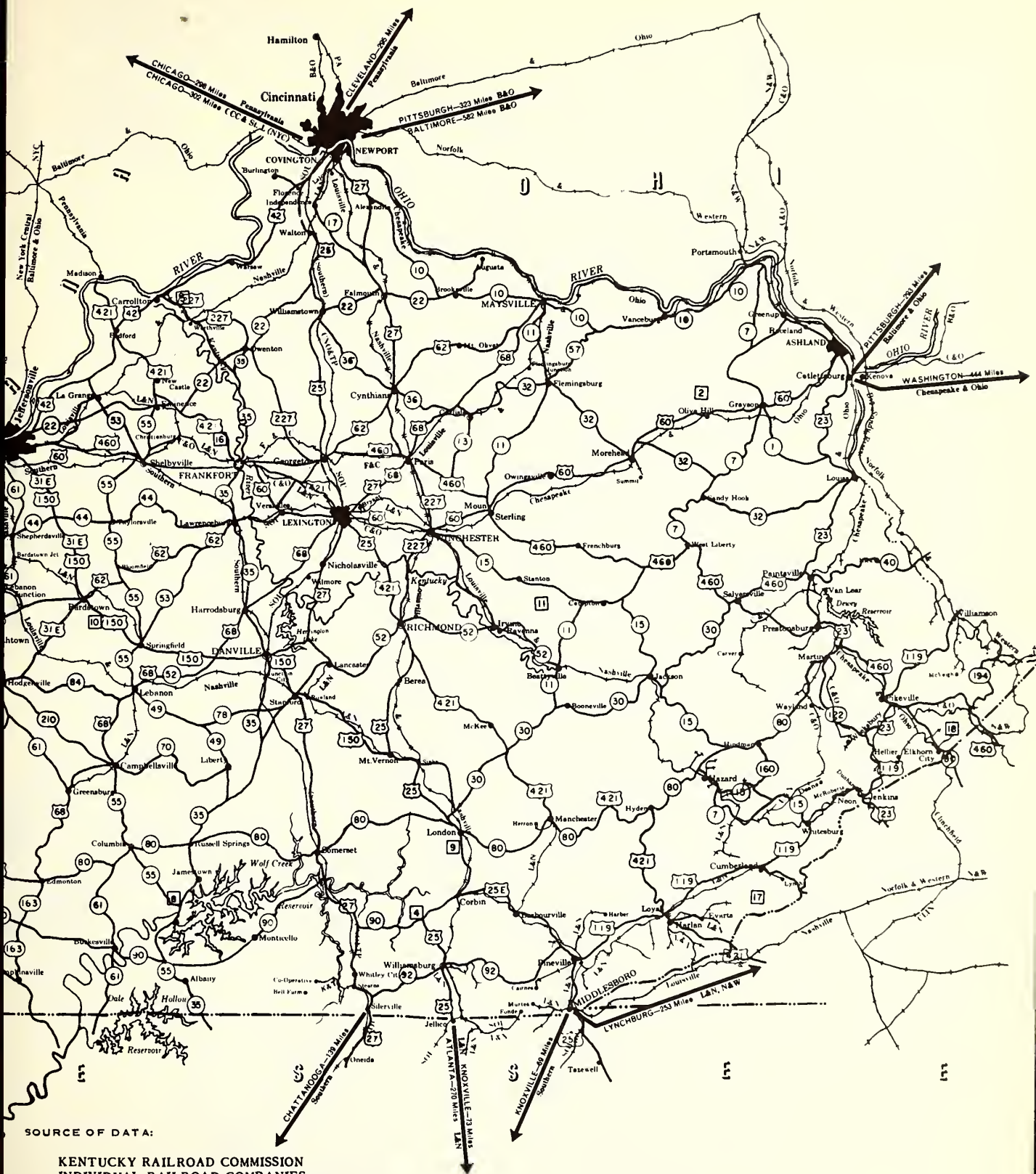
70 Ky. Route Markers
27 U. S. Route Markers

Compiled By
AGRICULTURAL and INDUSTRIAL
DEVELOPMENT BOARD
OF KENTUCKY

MILES
10 5 0 10 20



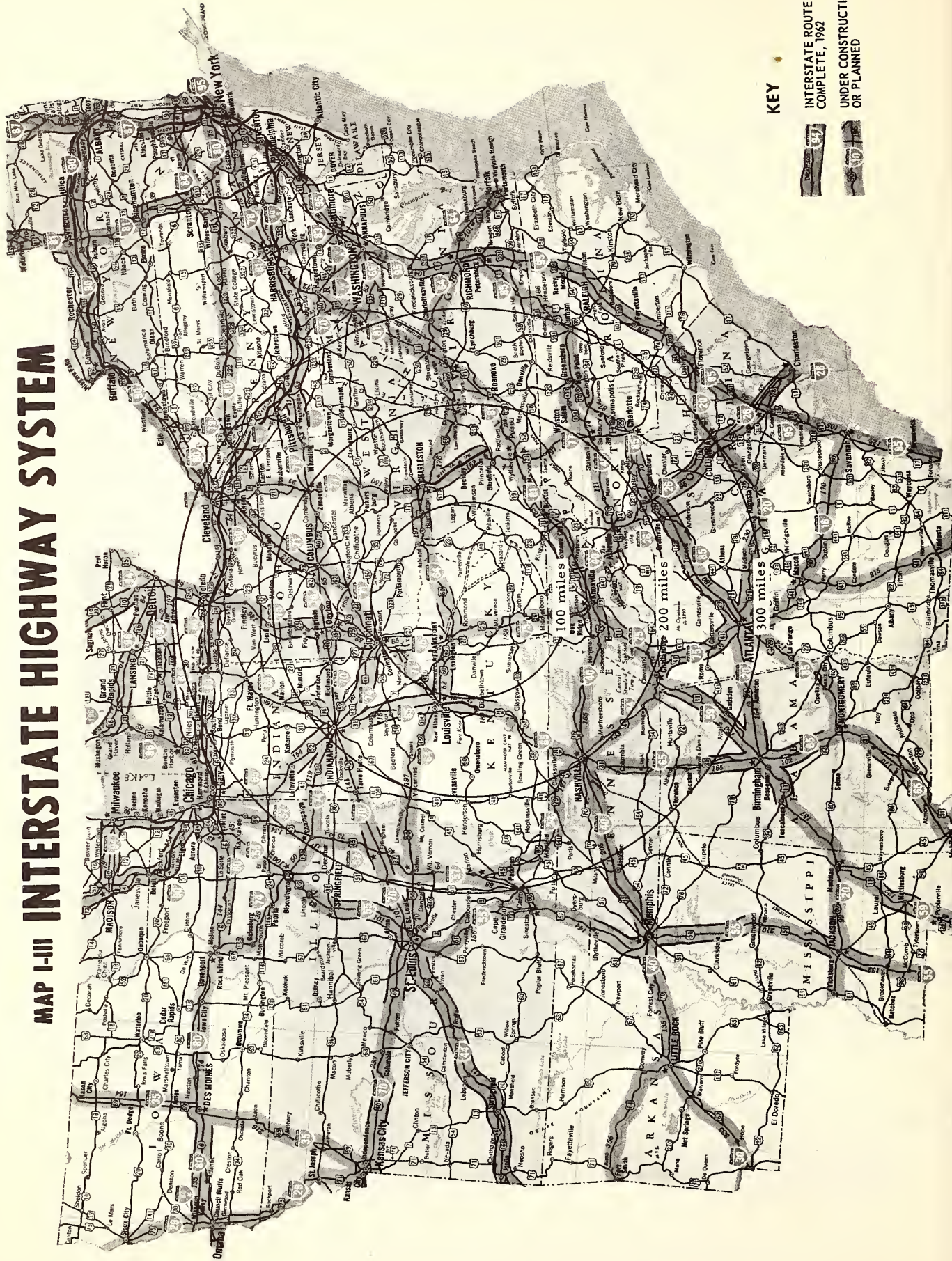
ALL WATERWAYS SHOWN ARE
NAVIGABLE BY COMMERCIAL CRAFT



SOURCE OF DATA:

KENTUCKY RAILROAD COMMISSION
INDIVIDUAL RAILROAD COMPANIES
OFFICIAL KENTUCKY DEPARTMENT OF
HIGHWAYS ROAD MAP

MAP I-III INTERSTATE HIGHWAY SYSTEM



KEY



INTERSTATE ROUTES
COMPLETE, 1962

UNDER CONSTRUCTION
OR PLANNED

haul truck shipments to major railroad terminals. Furthermore, the railroad companies serving the area might be willing to cooperate in the construction of spurs to industrial sites not already located along existing rail lines.

Although the existing transportation network in eastern Kentucky is adequate for large-scale industrialization, proper attention to site selection for the wood products complex described in this report will permit maximum utilization of both the existing road and rail net while, at the same time, giving maximum consideration to planned highway construction. No important railroad construction is to be anticipated, though the construction of industrial rail spurs will contribute to improving the existing rail net. The current Federal interstate highway construction program, to be completed in 1971, will greatly favor the development of industry in eastern Kentucky by bringing the interior of the region for the first time within easy and rapid truck-haul contact with major markets. The selection of a site for the proposed wood products complex must take these plans (and completed construction) into careful consideration. Existing and planned highways under the Interstate program are shown by Map I-III; it should be noted that many sections of highway shown as incomplete are already in advanced stages of construction. Concentric circles with radii of 100-, 200-, and 300-miles delimit the nominal market which can be served from eastern Kentucky. It is important to consider the extension of this market area to such important furniture manufacturing areas outside the nominal market as St. Louis, Chicago, Milwaukee, Grand Rapids, Detroit, Jamestown (New York), New York City area, Philadelphia, and Baltimore. These areas are located in high wage rate labor markets; the availability of furniture parts, frames, and dimension stock, for example, from the relatively low wage rate area of eastern Kentucky could more than justify the expense of freight to these cities.

Two of the three Interstate routes passing through Kentucky will directly affect the ease of shipping manufactured goods from eastern Kentucky: (1) route I-64, connecting Kansas City, St. Louis, Louisville, Ashland, and Charleston and connecting with route I-81 in the important furniture manufacturing region in Virginia's Shenandoah Valley; and (2) route I-75, connecting Detroit, Cincinnati, Louisville, Knoxville, and Atlanta—all important furniture producing areas, and providing access to other Interstate

routes passing through the important furniture areas in Memphis, Birmingham, and North Carolina.

Access to these Interstate routes is being facilitated by the construction of the Eastern Kentucky Turnpike, connecting with I-64 near Winchester and with access to I-75 from I-64, near Lexington. The Winchester-Campton leg of the Turnpike is scheduled for completion by the end of 1962; two eastern spurs, Campton-Hazard and Campton-Salyersville, are scheduled for completion in early 1964; and the final legs, Salyersville-Prestonsburg and Hazard-Whitesburg, will be open to traffic sometime in 1967. When it is completed, the eastern leg of the Turnpike will connect with U.S. 23 near Prestonsburg—providing access to I-64 at Ashland and eventual connections with I-77 and I-81, leading north to Cleveland and south to the Shenandoah Valley; the southeastern leg of the Turnpike will terminate at Whitesburg, connecting with U.S. 119 and other major highways leading to I-81—about 75 miles distant—or west to I-75. Both U.S. 23 and U.S. 119 are being improved.

As the southwestern edge of the area, I-75 will pass near London, Corbin, and Williamsburg; access to I-75 from the east will be facilitated by the reconstruction of a portion of U.S. 25-E, now underway between Pineville and Corbin. While it is possible to overestimate the impact of this new highway construction on the future of eastern Kentucky, it is significant that one of the larger truck lines serving the area is constructing new terminal facilities at Corbin. It is also apparent that improved highways will permit the use of larger and more efficient means of highway transportation than are now available in eastern Kentucky.

Table I-VII and Table I-VIII provide specimen freight rates for the shipment of lumber and wood products from Hazard, Kentucky, to major markets. The origin point has been arbitrarily determined and should not be considered as discriminating in favor of Hazard in the final selection of a site for the complex. It should also be noted that, in actual practice, it may be necessary to route shipments through one or more intermediate terminals or transfer points, a factor which may influence the determination of freight rates from any industrial site in eastern Kentucky. The freight rates were obtained from operating rail and truck transportation companies, but it is obvious that not all possible sites in eastern Kentucky could be surveyed. It is also probable that standard tariffs will be subject to negotiation between the complex

and the transportation companies once the complex begins to ship quantities of its products to particular markets. Highway freight classes are shown by Table I-IX.

Table I-X shows approximate transit times for freight shipments between several points in eastern Kentucky and major market centers. It is probable that the construction of the Interstate highways will materially reduce truck transit times over the next few years; rail transit times are not expected to change. The introduction of the piggy-back system of combined truck and rail transportation may be worth considering, however, as an interim means to take maximum advantage of the existing road net and the location of important rail terminals.

Communications

Telephone and telegraph service, usually an indicator of business and commercial activity, is severely limited in eastern Kentucky. In 1958, the region averaged one telephone for about each 17 persons, compared to a State average of one telephone

per seven inhabitants. During an interview of a prominent lumberman in a major Kentucky city, it was learned that his usual practice, lacking telephone facilities, was to forward shipping orders to his eastern Kentucky mill by mail. Although this situation may not be completely typical, it does suggest another reason why the level of business activity in the region is relatively low and unresponsive to market demands.

Mass communications media are also underdeveloped in eastern Kentucky. In 1958, there were only six daily newspapers (and 34 weekly or semi-weekly newspapers) serving the area. Most national and international news appears to come from metropolitan newspapers shipped into the area and frequently read the next day. Although there are about 20 radio stations serving the area, most TV viewers rely on stations in neighboring metropolitan areas such as Knoxville—a factor which helps them orient themselves away from the remainder of Kentucky and which has direct effects on the buying habits of the population. The effect of inadequate highways leading from

TABLE I-VII
RAIL FREIGHT RATES FROM HAZARD, KENTUCKY, FOR WOOD PRODUCTS

PRODUCT	DESTINATIONS (RATES IN CENTS PER 100 POUNDS)						
	Columbus Ohio	High Point N. Car.	Indianapolis Indiana	Louisville Kentucky	Memphis Tenn.	Richmond Va.	St. Louis Missouri
Chips							
Carload (36,000 lb)	64.5	58.5	68.0	30.5	59.5	67	75
LCL	134.0	182.0	134.0	112.0	179.0	193	162
Dressed lumber, planing mill prod., dimension							
Carload (36,000 lb)	64.5	68.0	68.0	35.5	68.0	81	75
LCL	134.0	186.0	134.0	112.0	179.0	193	162
Furniture parts							
Carload (30,000 lb)	99.0	134.0	99.0	83.0	--	142	120
LCL	135.0	184.0	135.0	113.0	--	194	164
Posts							
Carload (36,000 lb)	64.5	68.0	68.0	35.5	68.0	81	75
LCL	134.0	186.0	134.0	112.0	179.0	193	162
Particleboard							
Carload (60,000 lb)	48.5	--	51.5	--	68.0	--	--
LCL	147.0	204.0	147.0	123.0	179.0	212	178
Wooden cores							
Carload (22,000 lb)	94.0	118.0	94.0	72.0	--	124	114
LCL	173.0	236.0	173.0	145.0	--	250	210

TABLE I-VIII
TRUCK FREIGHT RATES FOR WOOD PRODUCTS
Present Rates Between Hazard, Kentucky*

RB No.	AND:	FREIGHT CLASSIFICATIONS (See Table I-IX)												
		85 LTL L2	85 LTL M2	70 LTL L2	70 LTL M2	70 TL	65 LTL L2	65 LTL M2	55 LTL L2	55 LTL M2	55 TL	50 LTL L2	50 LTL M2	35 TL
506	Chicago, Illinois	318	295	267	244	230	249	226	215	192	181	197	174	117
462	Cleveland, Ohio	307	284	256	233	220	240	217	206	183	173	190	167	110
337	Columbus, Ohio	262	239	220	197	186	205	182	178	155	146	164	141	93
477	Detroit, Michigan	307	284	256	233	220	240	217	206	183	173	190	167	110
333	Indianapolis, Indiana	262	239	220	197	186	205	182	178	155	146	164	141	93
494	St. Louis, Missouri	313	290	262	239	225	245	222	211	188	177	194	171	113
443	Asheville, N. C.	306	276	258	228	197	241	211	209	179	155	193	163	99
223	Cincinnati, Ohio	229	199	194	164	143	182	152	154	129	112	139	117	71
298	Charleston, W. Va.	254	224	215	185	160	202	172	175	145	126	160	132	80
349	Evansville, Indiana	276	246	232	202	176	218	188	189	159	138	175	145	88
616	High Point, N. C.	356	326	299	269	233	280	250	241	211	183	222	192	117
407	Nashville, Tenn.	296	266	249	219	190	233	203	202	172	149	187	157	95
459	Wytheville, Virginia	306	276	258	228	197	241	211	209	179	155	193	163	99
217	Louisville, Kentucky	219	192	181	158	148	167	146	144	125	117	130	112	74
		<u>L5</u>	<u>M5</u>	<u>L5</u>	<u>M5</u>	—	<u>L5</u>	<u>M5</u>	<u>L5</u>	<u>M5</u>	—	<u>L5</u>	<u>M5</u>	—
522	Pittsburgh, Pa.	350	319	294	263	239	275	244	237	206	188	219	188	135

* Rates in Cents per 100 Pounds

L2 - LTL Shipments less than 200 lbs

M2 - LTL Shipments 2000 lbs or more

L2 - LTL Shipments less than 500 lbs

M5 - LTL Shipments 500 lbs or more

TL - Truckload

eastern Kentucky to the western portions of Kentucky is reinforced by the effect of mass media originating from metropolitan areas in adjacent states—such as Huntington, West Virginia, and Knoxville, Tennessee—with the result that a considerable portion of eastern Kentucky's disposable income is spent outside Kentucky.

Utilities and Fuels

Electric power resources in eastern Kentucky are adequate to support the scale of increased industrialization envisaged in this report. Through most of the region, electric power is supplied by two private companies: the Kentucky Power Company in the area east and north of the line Vanceburg-Jackson-Whitesburg, and Kentucky Utilities Company, west and south of this line (see Map I-IV and Map I-V). The Eastern Kentucky Rural Electric Cooperative Corporation, in the northwest and TVA, in the southwest, represent the two major public power groups. All systems are inter-

TABLE I-IX
EXPLANATION OF HIGHWAY FREIGHT CLASSES
LUMBER AND WOOD PRODUCTS

Class 35:	Includes truckload shipments of lumber and millwork, veneer, chips, shavings, logs, pulpwood, flakeboard, furniture stock, and posts.
Class 50 (LTL):	Includes less-than-truckload shipments of chips, furniture stock, pulpwood, logs, posts.
Class 55 (TL):	Includes truckload lots of some furniture parts, finished wood panels, boat construction kits.
Class 55 (LTL):	Includes less-than-truckload shipments of flakeboard, hardwood floor blocks.
Class 65 (LTL):	Less-than-truckload shipments of lumber and veneer.
Class 70 (LTL):	Less-than-truckload shipments of baled wood shavings.
Class 70 (TL):	Truckload shipments of mixed furniture parts.
Class 85 (LTL):	Less-than-truckload shipments of some furniture parts and finished wood panels.

ELECTRIC POWER DISTRIBUTION

KENTUCKY POWER COMPANY

MAP I-IV



TABLE I-X: APPROXIMATE FREIGHT TRANSIT TIMES FROM
SELECTED LOCATIONS IN EASTERN KENTUCKY

DESTINATIONS	ORIGIN POINTS											
	HAZARD			IRVINE-RAVENNA			PRESTONSBURG			WILLIAMSBURG		
	Rail*	Truck**		Rail*	Truck**		Rail*	Truck**		Rail*	Truck**	
		TL	LTL		TL	LTL		TL	LTL		TL	LTL
Atlanta, Ga.	38.5	1	3	35.0	2	3	48.0	2	3	50.0	2	3
Birmingham, Ala.	68.0	2	5	25.0	2	3	72.0	3	4	48.0	2	3
Chicago, Ill.	41.0	1	2	44.0	1	3	24.0	2	2	44.0	2	3
Cincinnati, O.	16.0	1	2	20.0	1	1	24.0	1	2	21.5	1	2
Cleveland, O.	43.5	1	2	58.0	1	2	48.0	2	2	47.0	2	3
Detroit, Mich.	45.0	1	3	62.5	1	3	48.0	2	2	43.5	2	3
Knoxville, Tenn.	30.0	1	2	26.5	1	2	48.0	2	3	27.5	1	3
Louisville, Ky.	33.0	1	2	6.5	1	1	24.0	1	2	21.5	1	1
Nashville, Tenn.	45.5	1	2	18.0	1	2	24.0	2	2	41.5	2	2
New York, N. Y.	88.5	2	4	73.0	3	4	72.0	3	4	72.5	3	4
Pittsburgh, Pa.	51.5	NA	NA	60.0	2	3	24.0	2	3	48.5	2.5	3
St. Louis, Mo.	55.5	2	4	29.5	1	2	72.0	2	3	38.5	2	3

*hours **days

connected within the region and with electric power transmission grids in adjacent states. Within eastern Kentucky, the counties in the coal mining areas to the south and south-east are more adequately supplied with power than those in the central area and the Big Sandy Valley.

Typical electric service provided by the Kentucky Utilities Company is 60 cycle, alternating current with nominal delivered secondary voltages and phases as follows:

120 volts, single phase, two-wire
120/240 volts, single phase, three-wire
240, 480, or 208Y volts, three phase.

Nominal primary voltages, where available, are 2400, 4160Y, 7200, 8320Y, and 12, 470Y. Transmission line service is available at voltages of 34,500 and 69,000.

Nominal rates (subject to change under local conditions) comprise maximum load charges and energy charges as follows:

1. *Secondary service:* \$1.50 per kilowatt of the maximum load in each month, not less than \$180 per year, maximum load charge, plus energy charge below:

2. *Primary service:* \$1.35 per kilowatt of maximum load per month, but not less than \$405 per year, maximum load charge, plus energy charge below;
3. *Transmission line service:* \$1.25 per kilowatt of maximum load per month, minimum according to facilities required, plus energy charge below.

The standard energy charge, applying to all types of service described above, is as follows:

2.5¢/kwh for the first 2,000 kwh/month
1.7¢/kwh for the next 8,000 kwh/month
1.1¢/kwh for the next 40,000 kwh/month
1.0¢/kwh for the next 50,000 kwh/month
0.9¢/kwh for the next 400,000 kwh/month
0.8¢/kwh for the next 500,000 kwh/month
0.7¢/kwh for all in excess of 1 million kwh used per month.

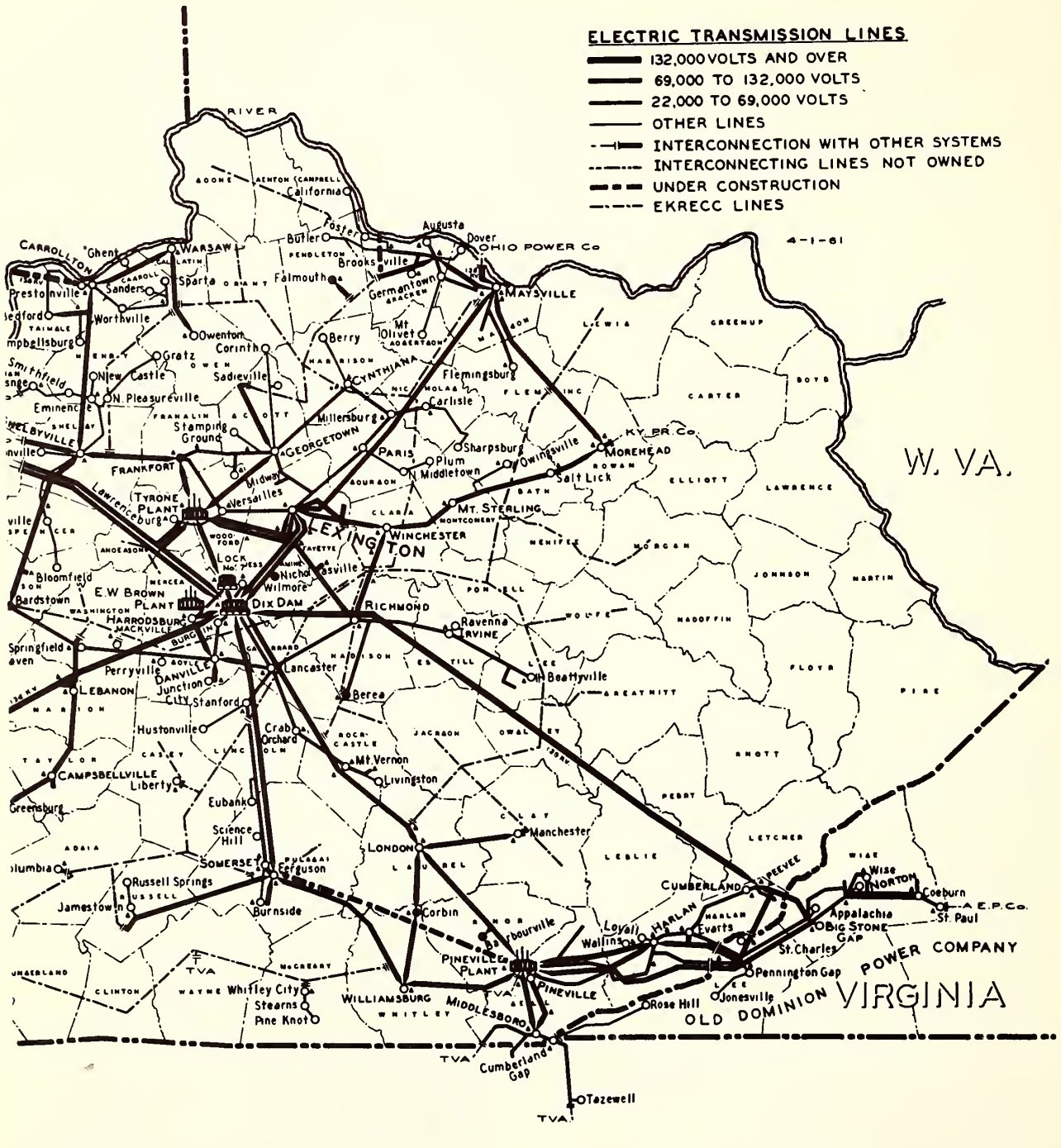
These charges are subject to a surcharge of .0013 cent per kilowatt hour for each 0.1 cent variation in the cost of fuel for steam generating stations above 21 cents per million B.t.u.; a similar credit is allowed for variation in the cost of fuel below 16 cents per million B.t.u.

Industrial water supplies are normally available in eastern Kentucky from the local community. Rates are scaled according to volume of usage and vary considerably from place to place. Minimum rates average

ELECTRIC POWER DISTRIBUTION

KENTUCKY UTILITIES COMPANY

MAP I-V



about \$2.25 per thousand gallons and drop off rapidly with increased use to about \$.35-.50 per thousand gallons for industrial users. An industrial plant using 100,000 gallons per month would be charged as follows:

<i>Location</i>	<i>Monthly Charge for 100,000 Gallons</i>	<i>Rate per 1000 Gallons in Excess of 100,000</i>
Hazard.....	\$62.70	\$.45
Irvine-Ravenna.....	110.05	.30
Prestonsburg.....	76.85	.50
Williamsburg.....	45.50	.35

Fuels are plentiful in Kentucky because of its own resources of coal, natural gas, and petroleum. High grade bituminous coal is readily available in almost any part of eastern Kentucky at prices estimated to be \$4.00 a ton, delivered to an industrial installation in significant quantities. Oil is refined at Somerset, in the western part of the region, and at Ashland, in the northeastern sector. Prices of fuel oil vary widely, however, according to grade and delivery point. For planning purposes, prices at 7.5 cents per gallon for bunker "C," 9.5 cents per gallon for industrial grade, and 16.0 cents per gallon for burner oil have been used in this report.

A major natural gas field is located in the Big Sandy Valley, covering an area within a 20-mile radius of Boldman (about 5 miles NW. of Pikeville). Minor fields are located near Pineville (Bell County), Barbourville (Knox County), Williamsburg (Whitley County), Oneida (Clay County), Jackson (Breathitt County), Boonesville (Owsley County), and Salyersville (Magoffin County). Important gas transmission lines run generally north-east from Tennessee, crossing eastern Kentucky from a point near Richmond (Madison County) to Ashland, on the Ohio River. Another major line runs east and west across the central portion of the region from Paintsville to Lexington.

Natural gas for industrial use is available in many eastern Kentucky counties. Some typical rates for selected locations are listed below, assuming minimum industrial use of 100,000 cu. ft. or more per month to operate a steam boiler associated with a lumber dry kiln.

<i>Location</i>	<i>Monthly Charge for 100,000 cu. ft.</i>	<i>Rate per 1000 cu. ft. in Excess of 100,000</i>
Hazard.....	\$64.30	\$.55 per M c.f.
Irvine-Ravenna.....	82.75	.765 per M c.f. to 300,000; .735 per M c.f. over 300,000.
Prestonsburg.....	57.80	.50 per M c.f.
Williamsburg.....	55.55	.50 per M c.f.

Forest Resources and Wood Products Industry

Forest Land

With about 11.5 million acres of forest land—45 percent of the land area of the State—Kentucky is one of the most heavily forested states in the eastern United States. Except for about 51,000 acres, representing protected woodlands in the Mammoth Cave parklands, Kentucky's woodlands are classed as commercial forests. About 49 percent of the forest land is located in the eastern Highland region of the State, about 40 percent in the Western Plateau region, and the remainder in the Bluegrass region. Although large-scale commercial lumbering operations virtually removed Kentucky's virgin forest cover in the half-century before 1930, the State's commercial sawtimber inventory in 1962 is estimated to be in excess of 25 billion board feet, mostly in hardwoods. An aggressive State fire-prevention system, improved methods of timber harvesting, and an increasingly effective program of small forest management have contributed to improved timber stands over the past 30 years.

The rugged Eastern Highlands region, one of the Nation's great coal-producing regions, has nearly half the forest land in Kentucky. Forest cover for the average county in this region is about 76 percent, with no county less than 64 percent forested and one—McCreary County—with 95 percent of its land in woodlands. In the Eastern Highlands, forests are rapidly reclaiming much of the land once farmed; here also are located the Cumberland National Forest, the Kentucky Ridge State Forest, and numerous State parks and recreation areas.

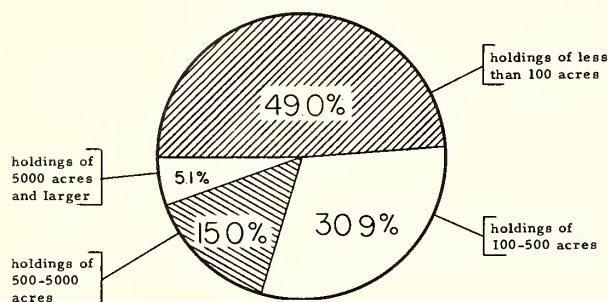
Ownership Patterns

According to the 1949 U.S. Forest Service inventory, about 94 percent of the commercial forest land in Kentucky was privately owned by 243,486 persons. The remainder comprised the 672,000 acres of the Cumberland National Forest and about 53,000 acres of State forest. Acreage of forest land held by county and municipal authorities was negligible. While the Forest Service inventory now in progress will provide more precise data on ownership in Kentucky, no significant changes in ownership patterns are expected except for acreages devoted to State parks.

About 46 percent of the privately owned woodland in Kentucky is in farm woodlands, averaging 30 acres in size. The balance of the total in private ownership is held for various commercial purposes, including logging operations, mining and recreation. Almost 80 percent of the total forest area in the State is in holdings of less than 500 acres.

DIAGRAM I-1

PRIVATE FOREST LAND OWNERSHIP PATTERN Kentucky-1949
per cent of total acreage



Ownership patterns in the Eastern Highlands region show considerable variation from the State averages. More than a million acres of forest land in this region are owned by a few coal companies, so-called "land companies," and logging operators. In addition, the land companies and coal companies reportedly hold mineral rights to another million acres of privately owned land in the Eastern Highlands, a fact which permits them to exercise effective control over large acreages of commercial timber. One such company thus reported controls over 200,000 acres (total land area), including 70,000 acres held in fee simple. Moreover, there are about 725,000 acres of State and Federal forest lands in the region. In the aggregate about 49 percent of the forest lands in the region may be held (or controlled) by a very small number of corporations and government agencies. Several of the larger corporations employ foresters and derive significant income from the sale of stumpage to logging operators.

In contrast to the extremely large ownerships of forest lands by a few corporate owners, a large number of small woodlot owners control about half the woodland acreage in the Eastern Highlands region, with holdings generally less than 500 acres. In 1958 a random sample of 110 small woodland owners in two eastern Kentucky counties showed that two-thirds of the properties were less than 100 acres in size. About half the owners

interviewed at that time had held their property less than 15 years; few of them had made any attempt to manage their woodlots in an effort to realize a supplemental income from timber sales.

Land Values and Taxes

No generally applicable figure can be applied to the per acre value of forest lands in the Eastern Highlands, though a number of experienced individuals cited \$20 to \$30 per acre as a common range in price. In general terms, the value of woodlands seems to have remained depressed because of the low average income of the Eastern Highlands and the lack of a commercial outlet for the timber from scattered small holdings.

Timberland by itself is less important in much of the region than mineral rights, which can be purchased independently. One study indicates that the right of access and free use of small timber exercised by holders of mineral rights tends to discourage owners of timberland from upgrading their surface holdings by good forest management (thus increasing the value of the land). Moreover, the increased practice of strip-mining means that the forest cover is often sacrificed in favor of the sub-surface coal deposits before it can be harvested economically.

A further factor acting to depress the value of timberland is the uniform State land tax. In 1962, the authorized tax base was \$2.05 per \$100 assessed valuation, with assessed valuation at a range of 28 percent to 29 percent. With no certain commercial outlet for about half of the harvestable timber in the region, the application of a uniform tax rate to "non-productive" forest land appears to be having an adverse effect on land values and tends to restrict the application of the State's forest management programs. The 1962 General Assembly has directed a study of the feasibility of a "severance tax" (yield tax) as a means of inducing small woodlot owners to apply better management practices. The results of this study are not expected to be available until the 1963 General Assembly session.

A State "fire tax," amounting to \$.02 per acre for forest lands, is administered by the State Division of Forestry. Until recently this tax has been administered only with difficulty. Each county is assessed a lump sum, based on the most recent forest census; the fire tax is collected by county officials and paid into State accounts. The law permits the county to pay the tax from general rev-

enues if it wishes, and no central records are kept of woodland ownership. Recently improved fire protection has demonstrated to owners of timber the benefits of the program and has spurred greater cooperation at the local level.

Regulation of Forest Lands

Aside from the "fire tax" and a statutory requirement that strip-mine operations be planted to trees or grass, the State relies on non-coercive regulation of its privately owned forest lands. This is accomplished by voluntary participation of woodlands' owners in the State's forest management program and by promotion of tree planting under the Agricultural Conservation Program. The State's cooperative forest management program is, however, limited to owners of 500 acres or less and thus has little immediate effect on the large-scale holdings located in the Eastern Highlands region.

Trends

Long term emphasis on improved forest management practices on privately owned woodlands is beginning to have some concrete results; but the major incentive for the owner of timberland must be the knowledge that a market exists for his forest harvest. In recent years, a few large land-owning corporations in eastern Kentucky have employed full-time foresters to supervise their extensive forests. Normally these companies do not harvest the timber on their lands, preferring to sell stumpage to contractors. The significant factor is that these companies are realizing important supplementary incomes from the sale of timber harvested from their lands, whereas many coal companies continue to disregard the above-ground resources in their emphasis on the underlying coal or use prime timber for marginal purposes (mine timber, rough lumber for temporary buildings, etc.).

Closely linked with the necessity for an economic outlet for standing timber is the current effort to revise the tax basis to permit the woodland owner to pay taxes on the value of the harvest, when harvested. Some forest economists consider this method of taxation to be a major incentive to improved management practices and, ultimately, to the improvement of woodlands on a larger scale than has been possible until now. It seems then, that a satisfactory market must be developed in order that the incidental benefits of this tax system may be realized.

Commercial Timber

The most reliable data applying to the forests of Kentucky derive from the results of a comprehensive survey begun in May 1948 and completed in June 1951. This survey, conducted by the U.S. Department of Agriculture, under authorization of the McSweeney McNary Act of 1928, provided among other things an inventory of commercial sawtimber in the State as of January 1, 1949. The status of this resource today, thirteen years later, is to some extent a matter of conjecture. The current U.S. Forest Service inventory in Kentucky will establish precise data, but this information will not be available for another year. Reasonably valid estimates of the timber resources in eastern Kentucky, based on the 1949 survey, are shown by Tables I-XI, XII, and XIII on pages 23, 24, 25. The tables show detailed breakdown of the timber resources summarized below:

	Total Volume	Availability to New Industry Each Year
Soft hardwood sawtimber (M b.f.).....	3,040,000	53,000
Dense hardwood sawtimber (M b.f.).....	11,860,000	201,000
Hardwood poletimber (cords).....	4,100,000	92,000
Softwood sawtimber (M b.f.).....	1,674,000	46,000
Softwood poletimber (cords).....	446,900	13,000

Eastern Kentucky Wood Products Industry

The 36 counties included in the eastern Kentucky region contain about 50 percent of the State's commercial forest land and account for about one-third of the total State workforce in the fields of forestry and the manufacture of lumber, furniture, and other wood products. While on casual observation it might appear that the area is broadly engaged in nearly all aspects of the wood products industry, closer evaluation reveals that the industry in eastern Kentucky is almost entirely oriented toward primary processing (logging and sawmilling) of the region's forest resources.

In 1958, about 81 percent of the workforce in the forest-based industries in eastern Kentucky were engaged in primary processing (logging and sawmilling); only about 15 percent were engaged in secondary processing, and four percent were engaged in the production of furniture. With regard to the situation in the State as a whole, the

DIAGRAM I-II
 ESTIMATED VOLUME OF HARDWOOD SAWTIMBER IN EASTERN KENTUCKY
 showing ratio of grade 1, 2 & 3 logs

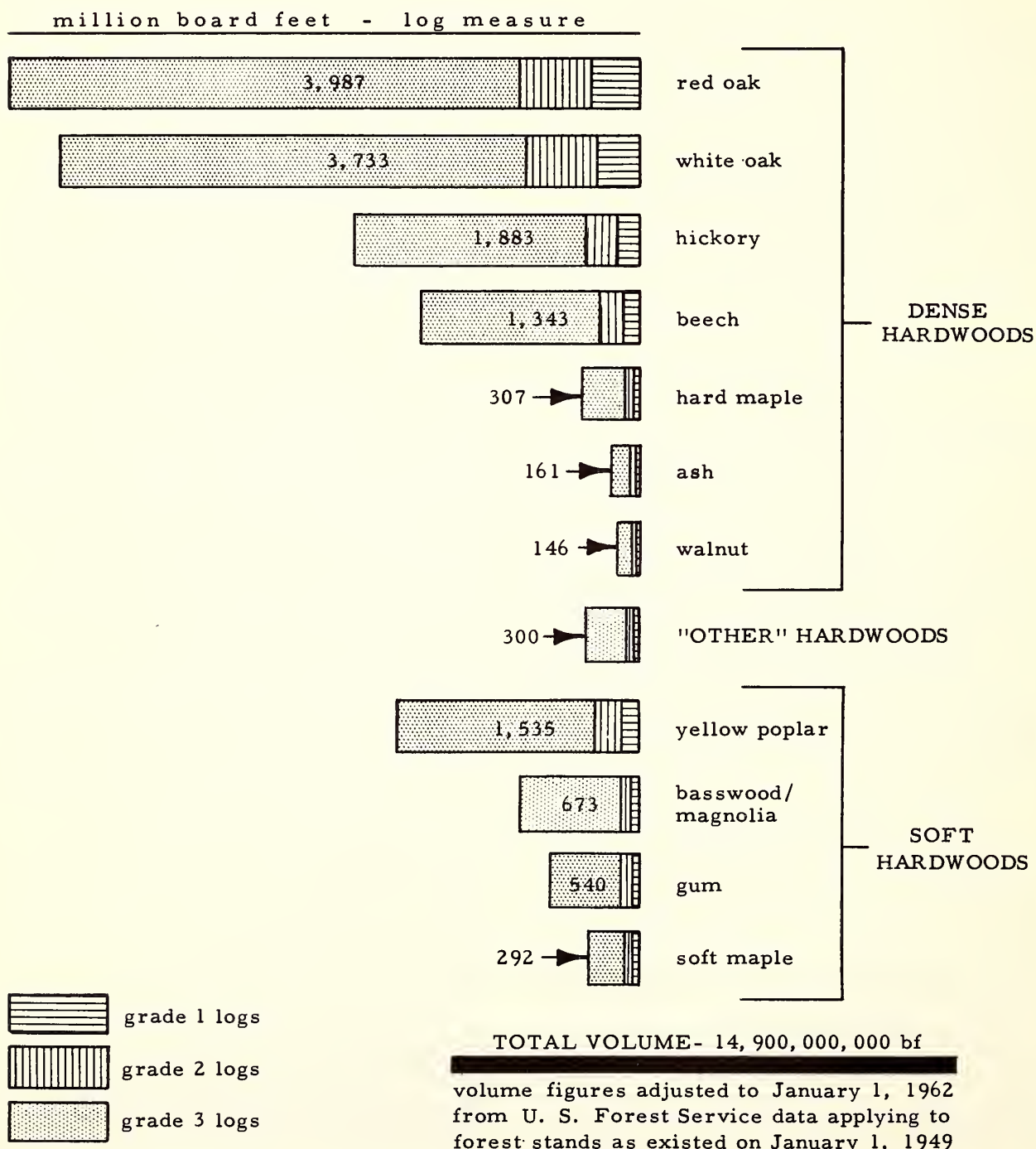


TABLE I-XI: ESTIMATED HARDWOOD RESOURCES - EASTERN KENTUCKY
(data projected to January 1, 1962 base)

A- SOFT HARDWOOD SAWTIMBER (thousand board feet)

TOTAL VOLUME IN AREA 3,040,000

Annual growth 178,000

Allowable annual cut* 142,000

Annual drain 89,000

VOLUME AVAILABLE FOR USE

BY NEW INDUSTRY - - - - - 53,000

Availability By Species

	<u>#1 LOGS</u>	<u>#2 LOGS</u>	<u>#3 LOGS</u>	<u>TOTAL</u>
Yellow poplar	1,954	2,864	21,947	26,765
Basswood/magnolia	855	1,253	9,605	11,713
Soft maple	689	1,009	7,736	9,434
Other soft hardwoods	372	544	4,172	5,088

B- DENSE & "OTHER" HARDWOOD SAWTIMBER (thousand board feet)

TOTAL VOLUME IN AREA 11,860,000

Annual growth 668,000

Allowable annual cut* 535,000

Annual drain 334,000

VOLUME AVAILABLE FOR USE

BY NEW INDUSTRY - - - - - 201,000

Availability By Species

	<u>#1 LOGS</u>	<u>#2 LOGS</u>	<u>#3 LOGS</u>	<u>TOTAL</u>
Red oaks	4,930	7,226	55,380	67,536
White oaks	4,622	6,745	51,918	63,315
Hickory	2,333	3,420	26,206	31,959
Beech	1,658	2,430	18,625	22,713
Hard maple	382	559	4,285	5,226
Ash	205	301	2,308	2,814
Walnut	176	257	1,979	2,412
Other hardwoods	367	538	4,120	5,025

* suggested limit 80% of growth

ESTIMATED HARDWOOD RESOURCES (cont'd)C- HARDWOOD POLETIMBER (cords)

TOTAL VOLUME IN AREA	4, 100, 000
Annual growth	232, 000
Allowable annual cut*	140, 000
Annual drain	48, 000
VOLUME AVAILABLE FOR USE	
BY NEW INDUSTRY - - - - -	92, 000

Availability By Species

Red oak	26, 100
White oak	21, 100
Yellow poplar	7, 400
Basswood/magnolia	2, 100
Soft maple	1, 300
Other hardwoods	34, 000

* suggested limit 60% of growth

TABLE I-XII: ESTIMATED VOLUME OF GROWING STOCK ON
COMMERCIAL FOREST LAND IN EASTERN KENTUCKY

data projected to January 1, 1962 base

Exclusive of sawtimber, cull trees, upper stems and limbs

TOTAL GROWING STOCK (cords)

TOTAL VOLUME	25, 135, 000
Annual growth	1, 471, 600
Hardwood species	1, 311, 200
Softwood species	160, 400

TABLE I-XIII: ESTIMATED SOFTWOOD RESOURCES - EASTERN KENTUCKY data projected to January 1, 1962 base

A- SOFTWOOD SAWTIMBER (thousand board feet)

TOTAL VOLUME IN AREA	1, 624, 000
Annual growth	92, 000
Allowable annual cut*	92, 000
Annual drain	46, 000
VOLUME AVAILABLE FOR USE	
BY NEW INDUSTRY - - - - -	46, 000

Availability By Species

Southern yellow pines	35, 420
Hemlock	6, 900
White pine	1, 380
Red cedar	1, 380
Cypress	920

B- SOFTWOOD POLETIMBER (cords)

TOTAL VOLUME IN AREA	466, 900
Annual growth	26, 000
Allowable annual cut*	26, 000
Annual drain	13, 000
VOLUME AVAILABLE FOR USE	
BY NEW INDUSTRY - - - - -	13, 000

Availability By Species

Southern yellow pines	10, 000
Hemlock	1, 950
White pine	400
Red cedar	390
Cypress	260

* suggested limit equal to growth

following relationships prevailed in eastern Kentucky in 1958:

	<i>Percent of State Plants</i>	<i>Percent of State Workforce</i>
Primary Processing.....	50.0	50.4
Secondary Processing.....	23.5	14.6
Furniture and Fixtures.....	8.6	3.1

Detailed comparative data for Kentucky and eastern Kentucky are contained in Table I-XIV. While there have been some changes since 1958 in the numbers of plants and the size of the workforce in forest-based industries, the relationships are reasonably valid for 1962.

Despite the relatively high proportion of the logs, lumber, and planing mill products produced in eastern Kentucky, the existing wage rates, skill levels, and techniques of harvesting the forest resources tend to encourage inefficient production and result in low returns for time and money expended.

An evaluation of 1958 lumber production in Kentucky shows that the State rates near the bottom in terms of production efficiency, compared to neighboring states:

<i>State</i>	<i>Annual Production Per Em- ployee— Logging and Saw- milling— (thousand board feet)</i>	<i>Annual Production Per Acre of Com- mercial Forest Land (board feet)</i>
Missouri.....	160	20.9
Ohio.....	102	37.3
Illinois.....	96	34.0
Indiana.....	89	38.4
Tennessee.....	84	50.0
Virginia.....	79	70.4
KENTUCKY.....	74	28.4
West Virginia.....	63	35.1

The factor of production per acre, shown above, may not indicate inefficient, high cost production. It does, however, indicate a

TABLE I-XIV: COMPARATIVE DATA ON WOOD PRODUCTS INDUSTRY
IN KENTUCKY AND EASTERN KENTUCKY, 1958

MANUFACTURING CATEGORY	State of Kentucky, 1958		Eastern Kentucky, 1958			
	No. Plants	Workforce	No. Plants	% Total Plants	Estimated Workforce	% Total Workforce
<u>Primary Processing</u>						
Logging Camps & Contractors	102	374	55	53.9	226	60.4
Sawmills & Planing Mills	495	4,034	246	49.7	2,094	51.9
Special Product Sawmills, nec	14	194*	3	21.4	44	22.7
Wood Preserving Plants	7	208*	4	51.1	59	28.3
TOTALS	618	4,810	308	50.0	2,423	50.4
<u>Secondary Processing</u>						
Millwork Plants	21	807*	1	4.8	6	0.7
Hardwood Dimension & Flooring	20	1,670*	5	25.0	329	19.7
Veneer and Plywood Plants	6	419*	1	16.7	37	8.8
Cooperage	12	842*	1	8.3	7	0.8
Prefabricated Wood Products	2	43*	--	--	--	--
Nailed Wood Boxes and Shook	7	237*	--	--	--	--
Veneer and Plywood Containers	2	43*	--	--	--	--
Wood Products, nec	34	498*	8	23.5	73	14.6
TOTALS	104	4,559	16	15.4	452	9.9
<u>Furniture and Fixtures</u>						
Wood Furniture, not Upholstered	42	2,686	3	7.1	52	1.9
Wood Furniture, Upholstered	19	948	3	15.8	45	4.7
Household Furniture, nec	1	79*	--	--	--	--
Public Building Furniture	5	89*	1	20.0	25	28.0
Partitions and Fixtures	13	181*	--	--	--	--
Furniture and Fixtures, nec	1	9*	--	--	--	--
TOTALS	81	3,992	7	8.6	122	3.1

Source: 1958 Census of Manufacturing, U. S. Dept. of Commerce.

relatively low level of harvesting of Kentucky's forest resources. In 1958, for example, Kentucky produced only about 10 percent of the lumber manufactured in the seven surrounding states from about 15 percent of the total acreage of commercial forests in the seven-state region. By contrast, Tennessee produced almost 20 percent of the total lumber manufactured in the region from about the same acreage as Kentucky. There were 128 logging camps in Tennessee in 1958, compared to 102 in Kentucky; and these logging camps employed only 475 men, compared to 374 loggers in Kentucky.

One explanation for this difference in productive capacity may lie in the fact that many Kentucky lumbermen are oriented toward the manufacture of high quality lumber, and loggers are handicapped by the relative inaccessibility of remaining stands of prime timber. Many eastern Kentucky lumbermen, furthermore, are limited by the fact that the markets for their products are located outside the producing area—and often outside the State. This factor imposes three handicaps: (1) variations in demand are seldom predictable, (2) grades and species are always limited, and (3) shipping charges reduce the competitive capacity of the primary producer.

A survey of the type and quantity of lumber and wood products shipped out-of-state from eastern Kentucky in 1961 was conducted recently by the Kentucky Division of Forestry. This survey and other information indicates that about 120 million board feet of logs and lumber were exported from eastern Kentucky during the year, or about one-third of the State's total production. The composition of known shipments was as follows:

<i>Products</i>	<i>Percent of Total Board Feet Reported</i>
Logs, veneer.....	0.5
Lumber, rough.....	81.0
Lumber, surfaced.....	7.4
Lumber, manufactured ¹	8.6
Other.....	2.5

Principal species represented in these shipments were as follows: oaks (red and white), 50.5 percent; poplar, 27.5 percent; and maples, 10.0 percent. About 93 percent of the lumber shipped was air dried only; about four percent was shipped green, and only about three percent was kiln dried. Out-of-state shipments were principally by truck (83.5

percent); virtually all truck deliveries were within a radius of 200 miles, to customers in surrounding and nearby states. Rail shipment (16.5 percent) considerably extended the market radius. Destinations of rail shipments reported included Baltimore, Chicago, Detroit, Minneapolis, Rochester (N.Y.), New England, and Canada, in addition to nearby markets.

The data in this section specify the condition of the lumber and wood products industry in eastern Kentucky: low-level exploitation of prime species, inefficient production—leading to high-cost production, little or no remanufacturing, and volume export of primary products. If efficient use is to be made of eastern Kentucky's forest resources, it is essential that the situation be turned around to permit greater utilization of lower-value species, more efficient production, and greatly increased remanufacturing—thus developing a larger market within the region for the primary forest products and permitting sales of a large volume of high-value secondary products to markets outside the region.

The application of these principles to one or more of the seven redevelopment areas designated in eastern Kentucky is the object of this report. Finally, therefore, it is appropriate to take a closer look at the existing situation in each of these areas, delineated by Map I-VI.

Two development areas in the western belt of manufacturing counties, the Northeast Kentucky Development Area and the East Lake Cumberland Development Area, have relatively large proportions of their workforces engaged in forest-based industry. These two areas now contain the bulk of the secondary wood processing industries of the entire region, clustered around Morehead, in the north (Rowan County), and Monticello (Wayne County) and Somerset (Pulaski County), in the south: planing mills, pallet plants, flooring mills, furniture dimension mills, charcoal retorts, etc. The third group of manufacturing counties, comprising the Kentucky River Foothills Development Area, has the smallest workforce of all in the forest-based industries, despite the fact that it lies astride the Cumberland National Forest. In these three areas, industrial diversification is more apparent than in the remaining areas, a fact only suggested here by the relatively low proportion of the manufacturing workforce in the wood products industries.

The other four development areas, in which coal dominates economic life, have relatively large proportions of their total manufac-

¹ Included are oak flooring, ties, dimension, and a small amount of glued stock.

turing workforces engaged in forest-based industry. With a few significant exceptions, "manufacturing" in these areas consists essentially of the production of primary products: saw and veneer logs, pulpwood, mine timbers, bolts, and rough lumber. In these four regions unemployment is relatively the highest, largely as a result of the displacement of labor from the coal mining industry.

The basis for these conditions in the wood products industry of the region is readily apparent from Table I-XV on page 29, depicting the number of installations by type in various processing fields located in each development area as of 1958. While there have been some changes since 1958, the emphasis on logging and sawmilling still prevails in all these development areas. The secondary processing facilities and furniture plants located in these development areas remain, with few exceptions, relatively small and inefficient. On the other hand, the comparatively large scale development of

logging and sawmilling in these areas could provide the basis for a greatly expanded wood products industry, particularly in the production of products which require the conversion of primary raw materials (sawlogs, cordwood, and rough lumber) to marketable end items and to which value is added by the expenditure of labor. Several possible products and related market potentials are discussed in detail in other sections of this report.

This brief analysis suggests that, while the entire region is well suited to forest-based industry, the greatest potential for rapid expansion of such industry lies in the following development areas: Cumberland Valley, Big Sandy Valley, Middle Kentucky River, and Upper Kentucky River. Extensive commercial forest cover, the existence of primary production (logging and lumbering), the available labor surplus, available labor skills, reasonably adequate transportation facilities, abundant power, and cheap fuel all contribute to this potential. In the immediate future,

MAP I-VI

EMPLOYEES IN FORESTRY AND WOOD PRODUCTS INDUSTRY - E. KY. 1960

KEY TO AREAS

- 1- NORTHEAST KENTUCKY
- 2- KENTUCKY RIVER FOOTHILLS
- 3- MIDDLE KENTUCKY RIVER
- 4- BIG SANDY VALLEY
- 5- EAST LAKE CUMBERLAND
- 6- CUMBERLAND VALLEY
- 7- UPPER KENTUCKY RIVER



AREA	% AREA WORKFORCE UNEMPLOYED 1960	AREA WORKFORCE ENGAGED IN FORESTRY & WOOD PRODUCTS INDUSTRY 1960		% MANUFACTURING WORKFORCE IN WOOD PRODUCTS (1960)	% AREA FORESTED
		No. Empl.	Per cent		
1	8.6	997	4.2	16.2	71
2	8.2	399	1.6	19.6	45
3	6.6	432	5.0	71.1	75
4	13.2	847	2.7	43.6	75.5
5	7.2	1,122	6.0	35.6	65
6	9.6	1,718	3.9	38.2	71
7	10.3	879	2.7	52.2	84

the Cumberland Valley area, which has the largest number of employees in forest-based industry, and the Upper Kentucky River Valley Area, well situated to supply the

furniture industry in North Carolina, Virginia, and Tennessee, seem to be particularly attractive for the development of secondary processing industry.

TABLE I-XV: DISTRIBUTION OF WOOD PRODUCTS INDUSTRIES IN
EASTERN KENTUCKY REDEVELOPMENT AREAS, 1958

MANUFACTURING CATEGORY	REDEVELOPMENT AREAS							TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
<u>Primary Processing</u>								
Logging Camps & Contractors	6	2	1	7	5	17	17	55
Sawmills & Planing Mills	36	18	16	39	36	76	25	246
Special Product Sawmills, nec	--	--	--	--	3	--	--	3
Wood Preserving Plants	1	1	--	--	1	1	--	4
INSTALLATIONS	42	21	17	46	45	94	42	308
<u>Secondary Processing</u>								
Millwork Plants	--	--	--	1	--	--	--	1
Hardwood Dimension & Flooring	1	--	--	--	4	--	--	5
Veneer and Plywood Plants	--	--	--	--	--	1	--	1
Cooperage	--	--	1	--	--	--	--	1
Wood Products, nec	2	--	1	1	2	2	--	8
INSTALLATIONS	3	0	2	2	6	3	0	16
<u>Furniture and Fixtures</u>								
Wood Furniture, not Upholstered	1	1	--	--	1	--	--	3
Wood Furniture, Upholstered	--	--	--	--	3	--	--	3
Public Building Furniture	--	--	--	--	--	1	--	1
INSTALLATIONS	1	1	0	0	4	1	0	7

Source: 1958 Census of Manufacturing, U. S. Dept. of Commerce

Section II

The Production Concept

Operational Concept

The environment that confronts forest based industry in eastern Kentucky must be understood and adjusted to in making plans to expand the scale of wood products manufacturing in the region. The most influential characteristics which are common to the region and which have served to shape the recommendations made in this report are:

1. It appears that the forest resources of the region have been "high-graded" (i.e., selective removal of the most valuable trees) and as a result there is a preponderance of middle to lower quality stock.
2. The region has not had the experience of supporting a durable or expanding wood products industry.
3. The pulp and paper industry, the furniture industry, and other processive industries have largely by-passed the region, and they now surround it with firmly entrenched competitive activity.
4. Certain sociological and economic characteristics of the region as reviewed in Section I have been—and in some instances still are—unfavorable toward industry.

Although limitations to vigorous business growth are implicit in the above, proper structuring and operational planning of a processing complex will have a salutary effect. The fact that resources have been high-graded can be countered by manufacturing a product line that does not depend upon the availability of the very best wood raw material. The lack of business and management acumen in the area with respect to wood products manufacture, a result of unusually restricted activity in the industry, can be overcome by the application of training programs and initial reliance upon outside management and supervisory talent. The competitive challenge posed by surrounding industry can be met squarely by a capable marketing organization supported by quality products that can be sold at acceptable prices. Fair business policies, a willingness to work with the local population, and a cooperative

attitude in dealings with independent businesses will do much to bring about favorable modification of sociological and economic traits identified with the region.

Several trends and conditions now common in the region will assist organized efforts to adapt to the environment. Among them, those considered particularly influential in assuring the success and durability of any scheme of forest based industrial activity are the following:

1. Organized labor in the region is gaining maturity and is heedful of enlightened practices and policies.
2. The region has large tracts of forest land ideally suited to the growth of valuable hardwood trees, and, given the application of forest management programs, the forest cover can be rapidly improved in quality and value.
3. Sufficient sawtimber and cordwood are available at competitive prices to sustain a sizeable processing complex for an indefinite period of time.
4. Local communities and the State government are anxious to support the development of an expanded forest products industry in the region.
5. Communications networks and the highway system throughout the region have been much improved in recent years and will be dramatically improved by about 1970.
6. Adequate markets for processed wood products, while largely outside of Kentucky, are located within a reasonable distance.

To develop an operating structure patterned to the unique requirements that will be confronted in eastern Kentucky is only part of the job. Trends and experiences as they apply to the manufacture and marketing of wood products in other parts of the Nation will also affect the conduct of business in Kentucky. Today's high speed media for transportation and communication have served to compress the Nation's industrial activities into compact business communities, and it is unlikely that satisfactory business growth can be achieved if thinking is

confined to the local scene. As a matter of fact, market research performed during this study has served to underscore the fact that local markets will not support consumption of the range and volume of wood products that must be manufactured in order to establish an industry that will add measurably to the economy of the region.

The need for consideration of nationwide industry trends, in this instance the hardwood industry, is emphasized by statistics applying to the use of hardwoods in the United States. During the period from 1955 through 1960 the annual consumption of hardwoods for all purposes dropped 26 percent; consumption of Appalachian hardwoods—Kentucky being classed as an Appalachian hardwood producer—has dropped 28 percent; and per capita consumption of hardwoods has dropped 32 percent. While data are not available for 1961 and 1962, the trend continues downward. These figures must be related to plans for expanding Kentucky's share of a broadly contracting market, and they are prima facie evidence that the methods and objectives of product manufacture must be patterned to market requirements.

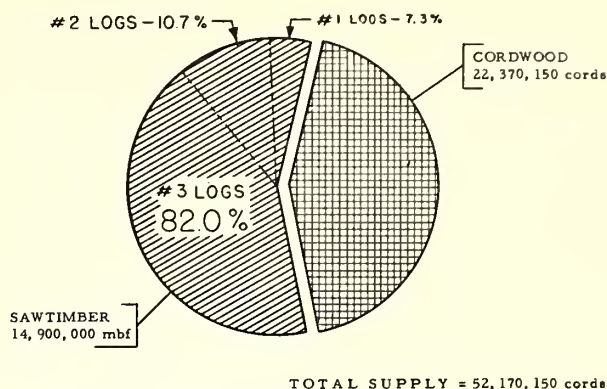
Year	Consumption of Appalachian Hardwoods (million board feet)	Total U. S. Consumption (million board feet)	Per Capita Consumption (board feet)
1955	3,582	8,481	50
1956	3,137	7,882	46
1957	2,943	6,115	35
1958	2,667	6,311	35
1959	2,610	6,402	35
1960	2,591	6,311	34

Operating Structure

The operating structure developed to satisfy requirements of the wood processing complex proposed in this report is shown by Diagram II-II on page 32. Investigation performed during Phase I and Phase II of this project resulted in the recommendation that a vertically integrated organization would best serve to bring about an expanded wood products industry. Subsequent studies have served to confirm this recommendation on the basis that within the confines of the problem both economic and marketing requirements can be best controlled by a central administrative authority. Also, an understanding of the raw material supply

DIAGRAM II-1

HARDWOOD RESOURCES OF EASTERN KENTUCKY



situation strongly supports the recommendation of a vertical organization, starting with the ownership and management of forest land.

The commercial forest resources in eastern Kentucky include a total growing stock of 52.2 million cords of hardwoods; 29.8 million cords of the total (14.9 billion board feet) are in the form of hardwood sawtimber. This is a vast amount of material which on cursory appraisal appears more than ample as a source of supply for any wood using program. The first impression is deceptive; the fact is that because of a wide array of species, a predominance of low quality stock, and a pattern of widely dispersed ownership of forest land, much of this material is not available within the limits of economic operation. Even the better quality material that is available does not automatically qualify as an economic resource. These circumstances impose a requirement for a systematic approach to the procurement of raw material that will satisfy the exact needs of the complex.

Open market purchase of saw logs and cordwood from private land owners and established commercial sources will not always be practicable in eastern Kentucky. This is due mainly to the lack of a soundly established market for logs within the State and the fact that the individuals owning timberland are reluctant to be subservient to the wills and needs of a wood industry in need of the raw material they might supply. While independence is a virtue, when applied under these circumstances it imposes a handicap on legitimate volume users of sawtimber and requires some form of hedge against unwarranted failure of presumably secure sources of supply. The brief reference to difficulties that could be encountered in procurement

of raw material is intended to indicate the depth of vertical integration that should be considered.

The harvesting of raw material and its transport from forest to mill preparatory to processing into manufactured products can be carried out in a number of ways. These include total reliance upon independent logging operators, exclusive internal handling, or contractual agreement based on the services of independent operators. The last relationship will provide the greatest advantage to the complex so long as positive control is maintained over delivery schedules and economy of operation. Actually, this vital link between the processing activities of the complex and the raw material resource must be subject to full administrative direction by the same management that is responsible for the manufacture and sale of products.

The diverse operations involved in converting saw logs and cordwood into finished products can be performed to best advantage by a single organization equipped with proc-

essing facilities that will enable manufacture of a broad product mix obtained from all grades and by-product forms of the original raw material.

The complex will be required to use as much of its total raw material as technical knowledge will permit. Each thousand board feet of lumber that is manufactured from average Appalachian hardwood logs—14" d.i.b. at the small end—will weigh 3300 pounds and will be attended by the production of approximately 3320 pounds of bark, sawdust, and solid wood residue.¹ The typical "peckerwood" sawmill operation will usually dispose of everything except lumber as waste without receiving appreciable revenue in return, even for the sale of solid material as firewood. As a matter of fact, many of the larger sawmill operations burn or otherwise discard all of their residue material.

In previous times, it was the usual practice

¹ Values are dry weight yields per 1000 board feet of average Appalachian hardwood lumber.

DIAGRAM II-II THE VERTICALLY INTEGRATED OPERATING STRUCTURE

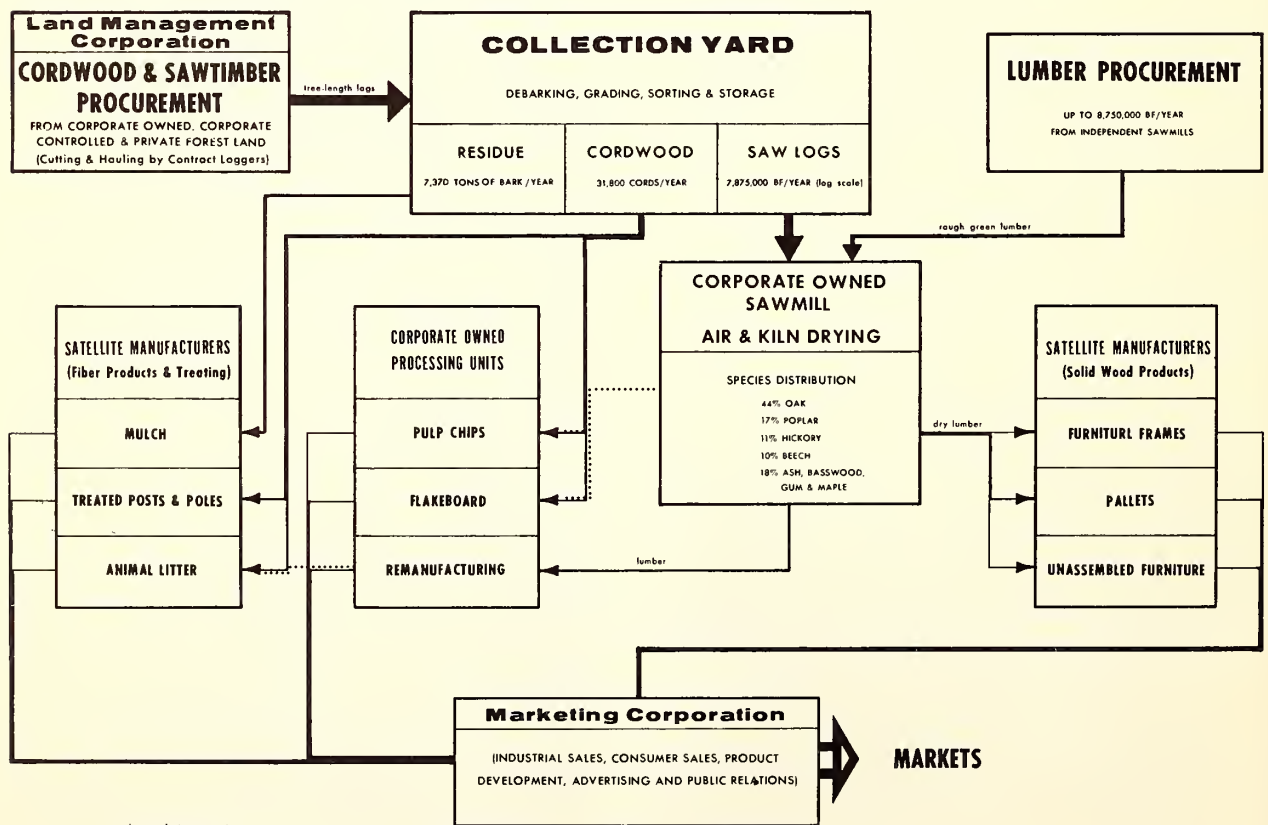
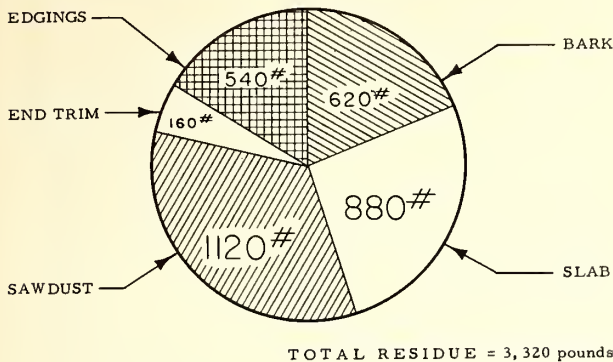


DIAGRAM II-III

RESIDUE FROM HARDWOOD SAW LOG CONVERSION
dry weight yields per 1000 board feet of lumber manufactured



to discard residues generated during the manufacture of lumber. Today this is changing, largely because the competition continually learns new ways and means to convert more and more residued material into salable products. To sell residue in the form of products, at a profit, permits the payment of higher stumpage prices and results in the ability to sell lumber and products derived from lumber at lower prices. Not long ago the above concept was theory. Today that theory is practice, and the operation that fails to do at least as well as its most enlightened competitor will suffer a permanent competitive disadvantage.

The most efficient means of accomplishing the conversion of low quality and residual materials into marketable products is to locate facilities for further conversion in the immediate proximity to the sawmill. The same principle applies to other uses of residues, such as for boiler fuel. Intermediate storage and transportation of residues to other locations preparatory to their conversion into products involves unnecessary expense and duplication of effort. Insofar as expenses for inventory, rehandling, and transportation can be minimized, the overall operation will benefit economically. This is a strong argument in favor of concentrating diverse processing facilities at one location.

While the procurement techniques and the economic utilization of residues are important, the determining factor in favor of a vertically integrated processing complex is the need to manufacture a product mix able to find ready market acceptance. The acquisition and satisfaction of markets is most effectively assured by integrating into the complex a sales organization eminently knowledgeable concerning market requirements. If product design and manufacture

are not made responsive to market requirements or trends, the processing complex will not be able to realize its maximum economic potential.

The combined effect of all the above factors establishes the need for extending the activities of the complex through the entire gamut of vertical integration, extending from the ownership of forest land to market servicing.

Functional Activities

Forest Land Ownership and Control

The complex should both own and control forest land. This requirement is premised on the private forest land ownership pattern in eastern Kentucky and the need for guaranteeing the complex a long range supply of quality sawtimber. While it is conceivable that actual ownership of land by the complex might be avoided, this is unlikely for it would entail widespread application of the alternative device of acquiring positive control over suitable forest acreage. Over the long term, the most likely situation will be a combination of land ownership and land control.

The organization should be staffed with professional foresters able to assume responsibility for securing suitable forest land and able to apply and administer both short and long range forest management programs to the land. This requirement can be met organizationally by establishing a subsidiary corporation that will devote its talents and energies to the growth and procurement of the basic wood resources required by the processing organization of the complex. Since the discharge of its responsibilities would place the subsidiary in close contact with the public, it should, therefore, be given responsibility for establishing and maintaining good public relations. In addition, it would assist independent loggers who will be depended upon to augment deliveries of saw logs and cordwood to the complex.

Log Collection Yard

Assuming an assured supply of suitable raw material from land owned and/or controlled by the processing complex, the first step to effective control of processing operations will be through the device of a log collection yard. The collection yard will serve as an inventory depot receiving saw logs and cordwood harvested from corporate owned or controlled lands and/or purchased from independent suppliers. While the lack of a

market for saw logs has been presented as one reason for extending vertical integration to land ownership, the possibility of developing a firm market in the future should not be overlooked. The complex might set this as an objective which it could accomplish by establishing itself as a responsible purchaser, worthy of the trust of the individual seller of logs. To encourage this development will serve to limit need for the complex to own forest acreage, and will also relieve it of a portion of the administrative and overhead costs that would be related to land ownership.

The log collection yard, in addition to serving as a raw material warehouse for the processing units, will have several other functions. Irrespective of source, saw logs, up to tree-length (36 feet long), will be debarked on delivery or soon thereafter. Removal of bark at this time will permit the fairest possible determination of the quality of each saw log and facilitate the subsequent bucking of tree-length material into lengths best suited to the product objectives of the complex. A single tree-length log might yield a veneer bolt, a high quality saw log, and a low quality saw log; the balance may best be suited for conversion into pulp chips. In this case, the value of the entire log would be determined by the sum of the relative values of its yield in rough products. By means of such handling it will be possible to bring about an improvement in quality exceeding log grades that an identical log would yield if bucked to length in the woods. Following bucking into length, and product and grade classification, the saw logs will be stored for subsequent processing, veneer bolts will be accumulated for sale to veneer manufacturers, and chippable material will be processed immediately into chips.

Primary Product Manufacture

Disregarding for the time being the fact that pulp chips will be manufactured by the log collection yard, the initial processing step for saw logs will be sawmill conversion into lumber. Since the lumber to be manufactured will be further processed by other units of the complex, it will be subject to production criteria not normally applied by a non-integrated sawmill. Certainly, efforts will be directed toward producing the best grade-yield from each log; but since the sawyer has in mind specific end product applications for each species and quality, he will be allowed a wider latitude of operation. Production efficiencies and saved time could well exceed

those permitted by the best run single-purpose sawmill.

The availability of a sizeable inventory of logs sorted by quality and species, as provided by the log collection yard, will serve to improve the efficiency of the sawmill and will make possible extended runs of a single species, or similar species. If species are sorted to grade, the mix of material flowing through the sawmill will be cut to a minimum, with the result that a greater amount of material can be processed easily without special equipment and with only a normal complement of workmen.

For purpose of developing the theme of operation of the processing complex, it is considered sufficient merely to mention at this point that sorting, grading, air drying, and kiln drying will follow as sequential steps after sawmilling. Grading to determine the most appropriate use for each piece of lumber will establish its end product destiny and related routing through subsequent processing steps. Following drying, it will be remanufactured into products by the principal organization, or it can be sold either as lumber or in semi-processed form to satellite operations or, under long term contract, to independent operations related to the complex.

Cordwood Conversion

Considerable amounts of cordwood will be available from independent sources and as thinnings from managed forest lands. Certain of this material, in particular the low density hardwoods, can be profitably converted into marketable products. As in the case of sawtimber, cordwood will be delivered to the collection yard, where it will be debarked and routed to its most appropriate means of conversion. The most important use for it is the proposed manufacture of flakeboard—using yellow poplar. Other products to which it is well suited are treated fence posts, chips, and animal litter. In certain instances, the most economic conversion of cordwood might be to saw it into lumber, as a step in the manufacture of solid wood core stock.

Remanufacturing Facilities

The term “remanufacturing” facilities is arbitrarily applied in this instance to embrace certain processing operations that will be owned by the principal organization. These operations will, perhaps, be the most automatic and efficient within the entire complex and will represent an aggregate in-

vestment out of reach of the satellites. The justification for this investment will be that the organization can manufacture a product line from rough lumber that will find a durable market and that will permit the maximum margin between selling price and manufacturing cost. In exchange for these advantages it will be necessary to maintain the tightest possible administrative control over production costs throughout each operation.

These facilities represent the key difference between the operation of an efficient sawmill and the broader scope of activity of a complex. They permit relating procurement of wood raw material to the most advantageous product mix. The various products resulting from these activities will be divided approximately equally between dimension materials to be processed further by satellite operations and products intended for open market sale. They will include planing mill products, core stock, laminates, solid wood paneling, and dimension.

Satellite Operations

The ability of the processing complex to achieve maximum utilization of all of its raw material in the most economic manner will depend upon a variety of small manufacturing units to augment the capacities of the principal organization. These units have been designated as satellite operations. In essence, they offer the opportunity for close administration of specialized product lines that are bothersome and result in inefficiencies in a larger organization. Nevertheless, these lines have good profit potentials, and they add to the ability of the complex to perform at maximum efficiency. In effect, the satellite operations are indispensable to the satisfactory performance of the overall complex.

Briefly explained at this point, the satellites will be individually under contract with the principal organization for both supply of their raw material and for sale of their finished products. This relationship will offer them advantages that if not available would preclude their existence. Through this arrangement, the satellites will be able to obtain raw material at a cost below prevailing market and certainly much below costs involved if they were to undertake primary conversion of saw logs on their own behalf. The sales tie would offer them the services of a professional marketing organization that they could not otherwise possibly afford. Lastly, as associates of a sort

of the complex they would be regarded with favor as loan risks by financing organizations and would thus qualify for financial assistance to an extent not otherwise possible. The relationship as conceived is purely symbiotic and has the added potential of serving the objective of accelerating the spread of business activity within the eastern Kentucky region.

The satellites will ordinarily manufacture a single product or, at most, will by necessity limit themselves to a restricted line of products. They will, however, remain quite responsive to market trends and be prepared to alter products whenever deemed advisable. Typical of single product manufacture would be pallets, unassembled furniture, and frames for upholstered furniture. Multi-product activities would be typified by a preservative treating plant and an operation making bark mulch and animal litter of different types.

Independent Operations

It has been evidenced that there is interest on the part of established manufacturers of wood products in evaluating the feasibility of locating new manufacturing facilities in reasonable proximity to the processing complex. This interest is premised on the assumption that the complex can serve as a dependable source of the raw materials required in the manufacture of their existing products. In no instance has there been an indication of willingness to effect a sales agreement with the complex.

The encouragement of independent operations premised on the use of processed raw materials supplied by the complex can be advantageous to the complex. Of course, each proposal should be examined to determine the advantages that would accrue to the complex. In instances where advantages are apparent, complete cooperation should be extended.

If the product of an interested independent is identical to or similar to products recommended for satellite manufacture, the relative merits of one arrangement as opposed to the other should be resolved to the best interest of the complex. In those instances where the raw material needs of the independent might modify the operational plan or primary conversion program of the complex, the situation should always be resolved in terms of the best long term advantage to the complex.

Close cooperation with such established manufacturers who wish to premise their

plans for expansion on advantages they will derive from the complex can materially assist rapid and wholesome growth of a wood processing industry throughout the State. This is particularly true because of the marketing and processing know-how that they could infuse into the situation.

Marketing

The key to a feasible procurement and processing complex such as outlined above, is in the ability to market products. From a business management standpoint it would be unsound to premise a venture of the scale being recommended on the exclusive services of an unaffiliated sales organization. To do so would inevitably result in control by the sales organization, to the complete jeopardy of the production organization.

The planned scale of manufacturing activity is not small enough to permit an informal approach to marketing. As an example, looking back momentarily into the wood products industry in eastern Kentucky, it can be seen that the inability of budding manufacturing efforts to compete at the market level has limited development. Frequently the owner and operator of a small manufacturing plant found himself totally preoccupied with the demands of production and unable to devote time to the task of selling the products that he was striving to produce. Ultimate failure is the penalty for lack of attention and response to market requirements.

The satellite operations included as part of the integrated processing complex will face many of the problems confronted by their predecessors who were unable to survive competitive forces. Having the professional marketing organization of the complex available to serve their needs will free the operators to devote their talents to the demands of production, thus permitting them to attain a level of operating efficiency that could not be reached under circumstances of divided attention between production and marketing.

The same conditions that favor the movement of satellite products through a marketing organization apply equally well to the requirements of the production activities carried on by the principal organization. The services of the subsidiary sales group will greatly enhance the ability to move a line of products that correlates market requirements with the objective of achieving maximum utilization of available wood material. The production division can be free to devote its talents to the demands involved

in accomplishing efficient production of quality products.

The marketing activities of the complex will be conducted by a subsidiary corporation that in addition to selling products will be responsible for advertising, customer relations, and liaison between the processing complex and the markets it intends to serve. Proper discharge of these responsibilities will require the application of professional marketing techniques, and the quality of results will determine the success or failure of the entire venture.

The importance of an effective approach to the sale of products that the complex will manufacture cannot be overstated. While the recommendations made in this report are concerned with analysis of raw material resources and the determination of efficient means of manufacturing products, they are fundamentally premised upon market requirements and projected market trends.

Résumé of Product Recommendations

The identification of products that should be manufactured by the processing complex is a prerequisite to a determination of the raw material requirements of the complex. Since technical product specifications will be established in Section III, the ensuing discussion is limited to brief explanation of the character and derivation of each product. The products treated below have been evaluated for marketability and conformity with the objectives and requirements of the complex; they are qualified and are recommended for manufacture.

The distribution, quality, and species of trees that typify the forest cover in eastern Kentucky have been major determinants in the selection of processing activities. The composition of the hardwood sawtimber inventory, shown by Diagram II-IV, provides a clear picture of the manner in which the tree species have influenced product selection.

A requirement to use logs in proportion to their quality and species distribution in the forest would result in a disturbing situation. Fortunately, a requirement of this nature will not be necessary because the quantity of raw material needed by the complex will aggregate only a fraction of the available sawtimber growing within the region. There will be no escape, however, from the fact that the average quality of material that the complex will have to work with will be poorer

than considered desirable by most sawmill operators.

Processing activities, unfortunately, are subject to the influence of two unrelated factors: market acceptance of products and the ability of the forest resource to provide the ideal raw material for their manufacture. Since it will not be possible to entirely match product needs with the resource, which would be the ideal situation, it will be up to the processing organization to adjust the differences between the two forces.

Trees being what they are, and technical ability to convert wood into products being what it is, the processing unit will be faced with a considerable inventory of low grade solid wood and processing residues. The economic conversion of as much as possible of this material into acceptable products is mandatory.

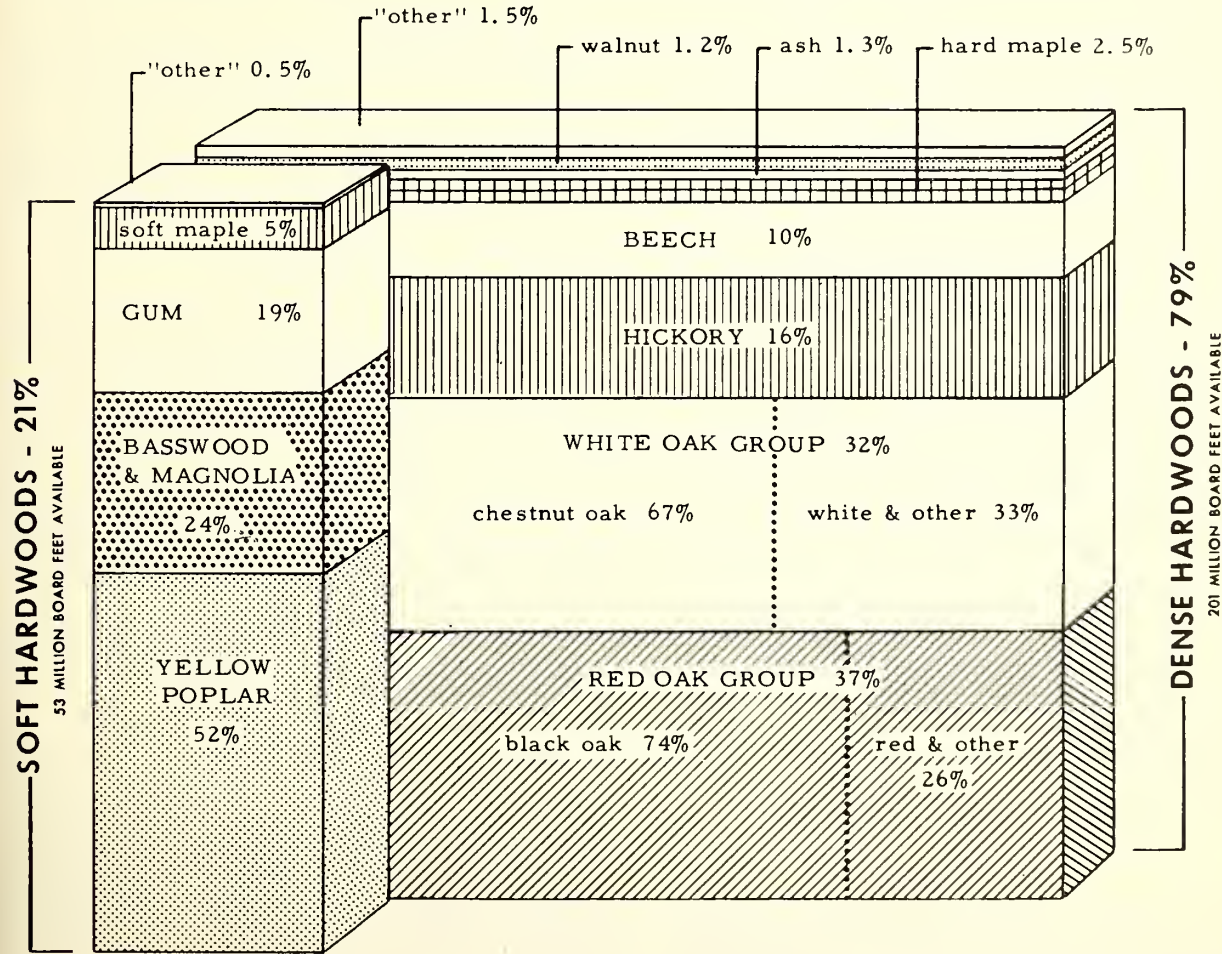
Rough Products

Rough products include the various forest grown materials developed as a direct result of logging operations. This group includes saw logs, cordwood, and poles; as a rule these products will not be sold by the complex. The complex will sell veneer bolts (described below) and perhaps limited quantities of high quality logs. It is expected that these products will be obtained during cutting operations on forest land owned or controlled by the complex.

Veneer Bolts

Description—Veneer bolts are short logs of the very finest quality that, because of the nature of the forest resource, are available in limited quantity. They usually occur as

DIAGRAM II-IV SPECIES COMPOSITION OF THE HARDWOOD SAWTIMBER INVENTORY IN EASTERN KENTUCKY



the butt logs of larger trees; the method of bucking, grading, and debarking of tree-length logs applied by the complex will permit recovery of bolts to best advantage. A steady high-price market exists for this product which, of course, is a basic source of various types of veneer.

The sale of veneer bolts will make available to the complex a higher return for this portion of the log than could be obtained through other conversion of the same material.

Principal Species Used—Ash, hard maple, red oaks, walnut, white oaks.

Primary Products

Primary products are those products obtained directly from the conversion of saw logs and cordwood.

Lumber

Description—Lumber will be manufactured by the complex only as a means of providing a basic raw material for the processed products that will be fabricated in subsequent operations.

The products of the sawmill will be judged differently than would be the case if the lumber was being manufactured for open market sale. Although grade inspection may be in accord with standard grade rules, there will be a tendency to sort for use rather than to grade individual boards as practiced by conventional sawmills. Nearly all lumber will be kiln dried; delivery to subsequent processing will follow—without further sorting.

Species to be converted into lumber will be determined by the aggregate requirements of the various processing units comprising the complex. These requirements will be balanced against the ability of the forest resource to provide the ideal species mix.

An exception to internal use of all lumber would be lumber which may be custom manufactured to satisfy some particular advantage the complex might offer to a customer. Advantage of this nature could derive from the ability to acquire superior sawtimber or the ability to manufacture better lumber.

Principal Species Used—Most commercial hardwood species common to the region.

Flakeboard

Description—Flakeboard is variously described, but it is essentially a reconstituted

wood product in panel form that is made by bonding together flakes from solid wood that has been reduced by mechanical means. Usage of the product is growing more rapidly at the present than that of any other wood product. The largest application is as a core in the manufacture of veneer-overlaid furniture panels. Other applications are store fixtures manufacture, cabinet work, interior construction, and structural paneling.

The manufacture of flakeboard requires considerable investment in plant and invokes a need for volume production in order to maintain a competitive position.

A recommendation to manufacture flakeboard must be related to some special advantage when the place of manufacture is somewhat removed from volume markets. Eastern Kentucky forests offer a significant advantage in their ability to provide adequate quantities of yellow poplar. This species has outstanding qualifications as a raw material for the manufacture of flakeboard and thus strongly supports the establishment of a production unit in the region.

The raw material for flake manufacture can be solid green residue derived from conversion of saw logs, or it can be in the form of cordwood. Volume requirements are such that a combination of these two sources will best serve the total need.

Principal Species Used—Yellow poplar, with controlled percentages of magnolia and basswood acceptable.

Pulp Chips

Description—Chips from hardwood species are finding an increasingly important application in the manufacture of pulp. Recent processing developments permit the use of mixed species, the dense hardwoods being as usable as the soft hardwoods. The present ability to use chips without regard to species segregation is particularly advantageous and, if so desired, will permit the complex to convert all green solid wood residue into this product.

Chips must be manufactured in conformity to specifications that determine optimum size of chip and establish limits to acceptance of defective material—such as char and decay. Their proper manufacture is contingent upon the availability of bark free material. Processing is a relatively simple operation that can be performed with equipment involving only moderate investment.

The yield of pulp chips normally obtained from conversion of saw logs into lumber ranges between 1.25 and 1.50 tons of green chips per 1000 board feet of production.

Under certain circumstances, in support of forest management objectives, it would be practicable for the complex to convert cord-wood directly into chips.

Principal Species Used—All hardwoods, particularly the dense species.

Remanufactured Products

Remanufactured products, within the context of this report, comprise a group of products obtained by processing lumber in a manner consistent with the overall objective of realizing the greatest upgrading of each board manufactured during primary conversion. For this reason, the group must include products capable of using available species in a ratio as close as possible to their occurrence in the forest. In most instances these products will be intermediate between lumber and a final commodity, such as furniture.

Solid Wood Paneling

Description—Solid wood paneling used as interior finishing for residential, commercial and office structures is an excellent product that is experiencing good market demand. Plywood paneling offers strong competition, but the demand for solid material should continue good because of its unique application to certain decorative treatments.

Successful and profitable marketing of paneling will require product upgrading by means of prefinishing and packaging. The sale of "panel stock" that has not been subject to refined manufacture will result in a very narrow profit margin.

Lumber best suited for manufacture into paneling should be specially selected at the lumber grading point. In some instances, premium logs of choice species can be converted into lumber as a special run intended only for the development of paneling.

Principal Species Used—Ash, hard maple, soft maple, red oaks, white oaks, yellow poplar, and walnut.

Core Stock

Description—Core stock is a basic commodity of the furniture industry and is used in the manufacture of veneer-overlaid panels. Markets for the product in terms of gross quantities are diminishing as a result of infiltration of its normal market by flakeboard and particle board. It is expected that the use of solid wood core stock will

eventually diminish to a rather negligible point.

The present market is sufficiently active to provide opportunities for sales of large quantities of core stock, specifically that made of yellow poplar. Enough furniture manufacturers are unwilling to use composition board products as core stock to assure continued demand for solid poplar core stock for a good number of years.

While on first judgement it may seem incongruous to recommend both the manufacture of flakeboard and solid wood core, actually there is only limited contest between the two products. Reduced to simple explanation, the use of flakeboard serves the needs of the middle-line furniture manufacturer, and solid wood core stock serves the needs of the quality line furniture manufacturer. Both classes of furniture manufacture provide opportunities for high volume sales.

While the major market for core stock lies with the furniture industry, some core material will find an outlet as core for slab doors and for load-bearing interior wall partitions. These markets are limited, but profitable.

Principal Species Used—Soft maple, and yellow poplar (with magnolia accepted as an equal species). Basswood is highly prized by some manufacturers for certain applications.

Furniture Dimension

Description—Furniture dimension includes a number of variously described component products that in essence are semi-fabricated parts used as raw material by furniture manufacturers, and others. The simplest product form is that which comprises pieces of solid wood of selected species manufactured according to length, width, and thickness specifications. A variant form is stock made to a specified size by gluing together smaller pieces. Still more refined types of products are those subject to machining operations such as shaping, routing, and drilling.

Dimension products permit the furniture manufacturer to avoid handling rough lumber and maintaining substantial equipment and factory space for such activities. The manufacture of dimension by the complex will provide an opportunity to upgrade lumber derived from saw log conversion. It also will permit the conversion of much material in poorer lumber grades into products that will sell at high margin.

The required species and specifications ap-

plied to dimension tend to vary seasonally and from year to year, as determined by the furniture market. Since these variations are somewhat unpredictable, it will be necessary for the complex to remain flexible in its ability to respond to demand. The arrangement of processing machinery required for its manufacture must be flexible so that production can be responsive to such changing requirements.

Principal Species Used—Ash, beech, gum, hard maple, soft maple, yellow poplar, red oak, white oak.

Laminated Products

Description—Laminated products manufactured by assembling and gluing together pieces of wood include end use products as well as products that are intermediate to other product objectives. End products are typified by laminated shelving, stair treads, etc., applied in the form in which manufactured. Products of the type that will be subject to further manufacture are typified by edge banding of flakeboard panels with solid wood and laminating of large furniture components to give qualities of strength and appearance not attainable by using solid wood.

Laminating in the sense used here is not to be confused with laminated structural beams and arches as used by the construction industry. While certain structural requirements exist for the use of hardwoods, most applications rely exclusively on the use of commercial softwoods.

There is an overlap between laminated products and dimension products as described above. This overlap carries through to the machinery used in the fabrication of the two types of products. Much of the machinery is interchangeable, thus permitting considerable flexibility in the layout and cost of production facilities to make both types.

Principal Species Used—Ash, beech, gum, hard maple, soft maple, yellow poplar, red oak, white oak.

Satellite Products

Satellite products as a descriptive category includes products best suited to satisfying the manufacturing and business objectives of the several satellite operations that will be established as part of the overall processing complex. In most instances, the manufacture of these products will involve minimum investment in plant and machinery. The products described below take advantage

of the expected species mix of the forest and provide an outlet for products developed during primary conversion activities, in accordance with the basic principle that every usable scrap of raw material should be utilized.

Pallets

Description—Pallets are a product that has experienced recent development to the extent of becoming a basic need for the nation's industrial activity. Companion to automation of industry, there has been an increased application of palletized handling during production, palletized shipping, and palletized distribution of manufactured products. It is expected that this upward trend will continue for the foreseeable future.

The design and construction of pallets is becoming more sophisticated and their production is becoming more competitive. These factors impose a need for mechanization of pallet manufacture. Competitive conditions forbid installation of expensive automatic equipment, and product characteristics limit the effectiveness of certain machine operations—such as automatic nailing. Mechanization that is accomplished must meet the limitations of this situation.

A satellite pallet manufacturing operation will be able to use quantities of oak and low grade lumber that would otherwise involve a disposal problem for the complex. Of particular advantage is the fact that sound knots and appearance defects are completely acceptable in most pallets.

Principal Species Used—Ash, beech, hickory, red oaks, white oaks.

Upholstered Furniture Frames

Description—Upholstered furniture frames are a specialized product manufactured in compliance with customer specifications and sold to manufacturers of upholstered furniture. Their manufacture requires close liaison with the purchaser, but has the advantage of not requiring the highly skilled production personnel normally associated with the furniture industry.

Frames are usually shipped to the point of use in knocked-down form and assembled after delivery by means of dowel and glue fastening. The product is competitive, and cannot stand shipment over large distances. There are, however, adequate marketing opportunities within a reasonable shipping radius of eastern Kentucky.

Facilities required to manufacture frames

involve the use of conventional wood machining equipment, with a minimum capital investment being required for a practical set-up. As with the manufacture of pallets, it is possible to use wood that is structurally sound, but subject to appearance defect that would normally reduce grade to an uneconomic point for the lumber manufacturer.

Principal Species Used—Ash, beech, gum, hard maple, soft maple, red oaks, white oaks.

Unassembled Furniture

Description—Unassembled furniture is growing in popularity and sale, particularly that made from hardwood species. For many years there has been a steady market for this type of furniture made from softwood species. The market developed by those products has expanded, and now includes patio, occasional, and utility furniture.

Companion to the production of furniture, there is opportunity to manufacture unassembled kits of other wood products—such as boats or cabinets. The same production machinery, personnel, and management engaged in the manufacture of furniture could be applied to the production of a broad product line.

Principal Species Used—Ash, beech, hickory, hard maple, soft maple, red oak, white oak.

Preservative Treated Products

Description—Preservative treated products can be manufactured to meet a number of use requirements presently satisfied by other materials. Factors within the region support the practicability of installing treating facilities as part of the processing ability of the complex, despite the knowledge that existing markets are exceedingly competitive and limited in size. Normally the nature of the existing market for treated products would preclude their further consideration. In this case, however, the market potential available is unusually good; and it is felt that a manufacturing start based on a limited product line offers an opportunity to expand a dormant market into significant proportions.

The present market provides opportunities for sales of fence posts and a more limited potential for sign posts and highway guard rail posts. Needs developed by fencing Bluegrass horse farms indicate a sales potential for factory painted posts and rails. The

treating process, to be compatible with product needs, should use water-borne preservatives applied under pressure. Wood for treatment can be obtained as cordwood from poletimber stands, or it can be in the form of core squares manufactured by the sawmill.

Principal Species Used—Ash, beech, hickory, soft maple, hard maple, chestnut oak.

Bark Mulch

Description—Bark mulch is manufactured from bark residue resulting from the debarking of saw logs. Processing bark into mulch requires little equipment and limited investment and involves the simple steps of separation of wood fiber from the bark and milling to particle size. Moisture content of the refined bark is not controlled, resulting in sale of the product by volume measure. Commercial markets are supplied by bulk deliveries, and product intended for consumer sales is packaged in large moisture resistant bags—about 4.25 cubic feet per bag.

The principal competitive product is peat moss, which is regarded by the nursery industry as being the standard for mulching materials. Bark mulch enjoys a comparative use advantage by having greater lasting ability than peat moss.

Principal Species Used—Ash, basswood, beech, elm, gum, hard maple, soft maple, magnolia, and yellow poplar.

Animal Litter

Description—Animal litter is a product grouping that includes several individual products and product applications premised on the use of shavings and wood particles.

Shavings are commonly used as chicken litter, and recently they have experienced increased use as hog and cattle litter. The applications call for dried and baled shavings, at best a crude product. They are a by-product of wood machining operations, or they can be manufactured from soft hardwood cordwood by conversion of whole logs in suitably designed machines. Processing is ordinarily confined to drying, the principal objective being to reduce shipping weight to a minimum.

Particles are finding increased use by the more sophisticated animal breeding industry that produces animals for laboratory and other experimental purposes. Specifications applying to particle products are somewhat

strict, indicating need for accurate drying, sterilization, and packaging in moisture proof containers. They are manufactured by milling shavings or chips. Only the light colored, odorless species of soft hardwoods are acceptable. Drying, which will follow milling, has a product function in that it brings the material to its maximum absorbency—a feature required in small animal breeding.

Principal Species Used—Basswood, soft maple, magnolia, and yellow poplar for particle type litter; all soft hardwood species for shavings.

Wood Raw Material Requirements

A determination of the quantity and species of wood raw material that will be required in the form of saw logs and cordwood is fundamental to the design and location of the physical plant and the planning of the business conduct of the processing complex. The production capacity of the sawmill, the starting point in the manufacturing cycle, has been established as 35,000 board feet of rough green lumber per eight hour operating shift. Industry experience has confirmed that this level of production is about the optimum for efficient conversion of hardwood species into lumber. The total quantity of lumber produced by the sawmill will be the total available for all subsequent operations, unless it is augmented by procurement of lumber from sources outside the complex.

A requirement to procure lumber in excess of the production of the sawmill becomes obvious when the aggregate needs of all processing units are totaled. The necessary input of each unit is enough raw material to support production at an economic level of operating performance. If 40,000 board feet is established as the total daily consumption of rough lumber by remanufacturing operations of the principal organization, a net deficit of 5000 board feet per day in excess of sawmill production results. An additional consumption of 20,000 board feet of lumber per day to sustain efficient operation of a satellite pallet manufacturing plant, 5000 board feet of core squares and lumber per day for a satellite treating plant; and the conversion of 5000 board feet per day of select quality lumber into solid paneling means that another 30,000 board feet must be procured from supplemental sources.

From the above, the total daily lumber

needs are 70,000 board feet, of which 35,000 board feet are to be obtained from the sawmill operation and 35,000 board feet must be purchased from outside sources. The procurement and internal application of this material is shown by Diagram II-V. The quantities of material shown by the diagram represent fully developed activity by all units of the complex; it is not implied that the complex must commence or sustain business at this level of performance. The dependence placed upon a secure source of lumber supply from outside sources will serve to stimulate other regional forest industry activity by providing a market for the output of small local sawmills. If correctly handled, this arrangement should have a considerable economic impact within the region about the operation at the same time that it represents a favorable arrangement for the complex.

The conversion of saw logs into lumber is normally accompanied by the development of a quantity of lumber in excess of the measured footage of saw logs used in its manufacture. This is due to the relationship between log scale and lumber measurement as used by the lumber industry. The excess of lumber that is developed is called "overrun"; and, in the conversion of Appalachian hardwoods, it can average as much as fifteen percent in excess of the footage determined by log scale. To allow for an anticipated heavy usage of low grade saw logs, the amount of overrun expected by the complex has been set at the arbitrarily low value of ten percent. On this basis, a sawmill cut of 35,000 board feet of lumber will consume slightly less than 31,500 board feet (log scale) of saw logs. This is the amount of saw log material that must be obtained to run the sawmill at the rate of one operating shift per eight hour day.

The manufacture of flakeboard will impose a requirement for 93 cords of yellow poplar per day.¹ This quantity of cordwood will only partly satisfy needs and will be supplemented with 6.1 tons per day of green solid wood² generated as residue during the sawmill conversion of yellow poplar saw logs. Magnolia and basswood can be included with the yellow poplar without jeopardizing the quality of the end product. Total raw material requirement is premised upon a flakeboard production unit operating at a capacity of 100 tons of finished product per 24 hour operating day, for 300 days per year.

¹ One cord (128 cubic feet) of cordwood will yield 1 ton of dry wood material.

² One ton of green solid wood (at 80 percent MC value) will yield 0.56 tons of dry flakes.

The preservative treating plant will use cordwood, core squares, and lumber from sawmill operations. The unit has been sized to treat 10,000 board feet of raw material per eight hour operating day. One half of its capacity will be applied to treating round posts, requiring the procurement of five cords per day in the form of poles and cordwood. The remaining capacity will be used to treat up to 5000 board feet of lumber per day; the end products will be posts and rails for rail fences, sign posts, poles, and possibly highway guard rail posts. It will be a simple matter to adjust these product ratios to markets as a result of sales experience.

By carefully balancing the species requirement of each product against the availability of species within the region it has been possible to arrive at a usable estimate of the species/quantity relationship that will serve the needs of the complex. This estimate based on the total demand for wood raw material that could ultimately develop through activity of the complex, is provided

by Table II-II. An important consideration evidenced by the table is the projected heavy requirement for yellow poplar (50.4 percent of the total); of the total requirement of 16,538 thousand board feet per year, only 15.7 percent is required in the form of saw logs and 84.3 percent as cordwood. Much of the poplar would be acceptable as green solid-wood residue, and it is anticipated that small sawmills will serve as a source of residue and thus reduce the requirement for procurement in cordwood form. Also, uppers and large limbs could be used to meet requirements.

The percentage relationship between species to be used in the form of saw logs and lumber, exclusive of cordwood needs, is not included in Table II-II. The separate calculation of the needs of the complex for saw logs and lumber that follows shows a close correspondence to the average composition of hardwood sawtimber stands in eastern Kentucky.

TABLE II-II ESTIMATED ANNUAL RAW MATERIAL REQUIREMENTS - BY SPECIES

	ASH	BASSWOOD	BEECH	GUM	HICKORY	HARD MAPLE	SOFT MAPLE	MAGNOLIA	RED OAKS	WHITE OAKS (incl. chestnut)	YELLOW POPLAR	WALNUT	TOTALS	% OF TOTAL
<u>SAW LOGS</u> ^{1/} (mbf log scale)	421	113	815	310	872	282	169	54	2,075	1,383	1,294	84	7,875	24.0
<u>LUMBER</u> ^{2/} (mbf lumber scale)	468	125	906	344	969	312	188	63	2,306	1,537	1,438	93	8,750	24.0
<u>CORDWOOD</u> (cords) ^{3/}		2,500					1,000	1,500	1,250		27,900		34,150	52.0
<u>TOTALS</u> -mbf log scale	842	1,476	1,630	620	1,744	564	838	864	4,775	2,766	16,538	168	32,825	
% OF TOTAL	2.57	4.50	4.97	1.89	5.31	1.72	2.55	2.63	14.55	8.43	50.38	0.51	100.0	100.0

^{1/} raw material for sawmill operation - assuming 10% overrun in conversion into lumber

^{2/} purchased from independent sawmills

^{3/} 2 cords = 1,000 board feet/log scale

DIAGRAM II-V **PLANNED DAILY PROCESSING CAPACITIES**

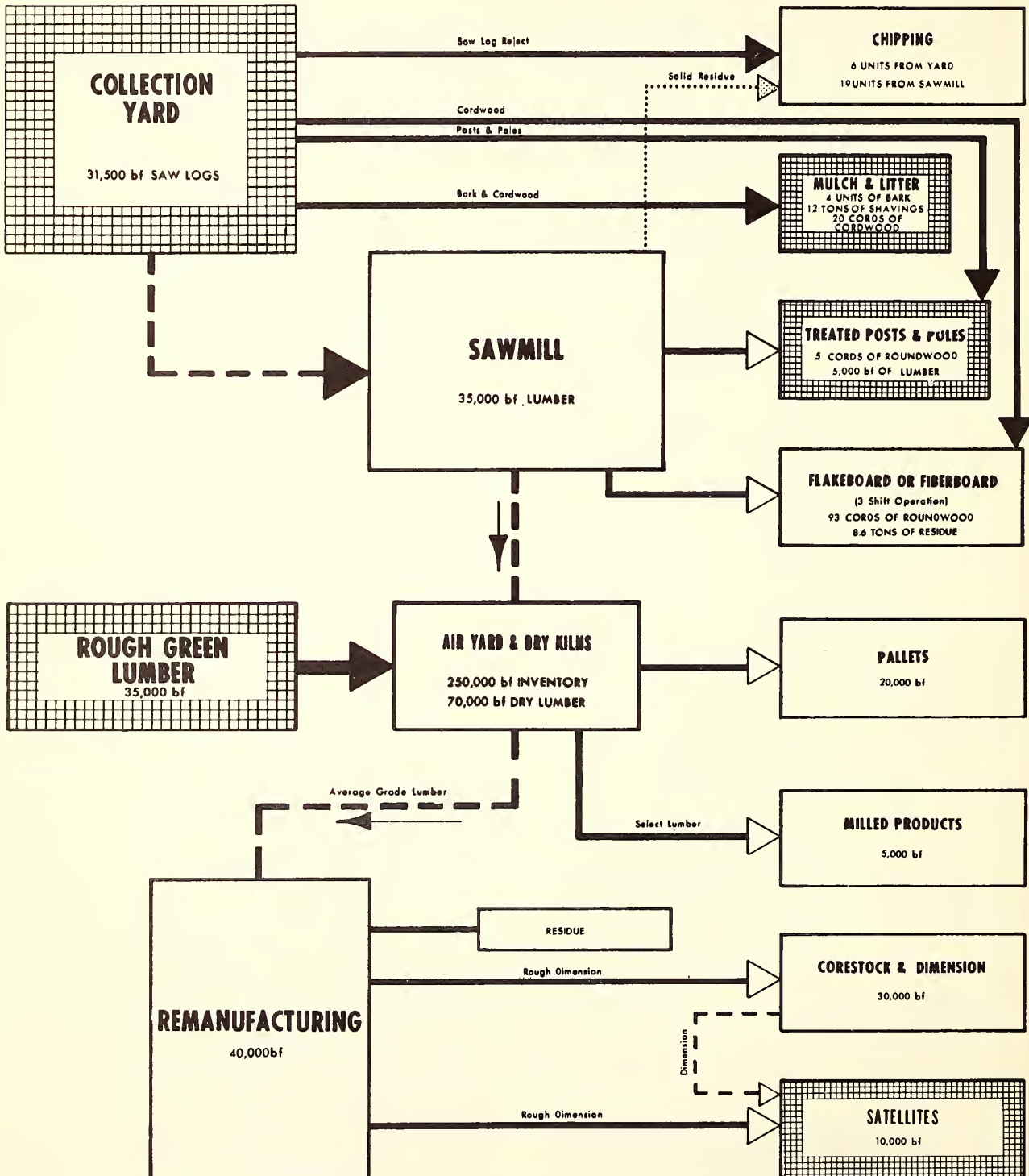


TABLE II-III
RELATIONSHIP OF SAWTIMBER CONSUMPTION
TO FOREST COMPOSITION
Hardwood Species

SPECIES	FOREST COMPOSITION (% of total)	CONSUMPTION (% of total)
Ash	1	5.4
Basswood	4	1.4
Beech	8	10.4
Gum	4	3.9
Hickory	13	11.1
Hard Maple	2	3.6
Soft Maple	1	2.1
Magnolia	1	0.7
Red Oaks	29	26.3
White Oaks	25	17.6
Yellow Poplar	10	16.4
Walnut	1	1.1
"Other" Hardwoods	2	----
TOTAL	100%	100%

Wood Raw Material Procurement

The magnitude of the task encountered in procuring wood raw material to supply the manufacturing activities of the complex will at any one time be related directly to the total activity of its several processing units. The most extreme condition would be that imposed by placing the complex into initial operation with all units functioning at their optimum capacities. In this instance, there would be superimposed upon the existing forestry industry in eastern Kentucky an additional daily demand for 126,600 board feet of wood in the forms of saw logs, cordwood, and rough green lumber. It is unlikely that any amount of planning or foresight by the management of the complex would result in the immediate satisfaction of this requirement. The point of greatest difficulty probably would be in filling the need for 35,000 board feet of rough green lumber to supplement the capacity of the corporation sawmill.

The tremendous difficulties inherent in accomplishing start-up of all processing units within a short span of time precludes planning for immediate attainment of the optimum operating level of the complex. The logical alternative will be to initiate a reasonable start-up demand upon the raw material resource, to be expanded in volume as operating techniques, business capacities and availability of the resource improve. With the preceding in mind, it becomes clear that the selection of the start-up configuration of the complex is a decision that must

be withheld until the area of operation and details of organization have been decided. This report is necessarily limited to conveying adequate information to allow it to serve as a useful tool in resolving these important elements of establishing the manufacturing activity.

The treatment of the subject of raw material procurement and preparation presented below is premised on requirements that will be imposed when the complex is operating at optimum processing capacity. The annual demand for wood raw material, as shown by Table II-II, will be 7875 thousand board feet of saw logs, 8750 thousand board feet of rough green lumber from area sawmills, and 34,150 cords of round wood.

The complex will necessarily procure saw logs by two methods: (1) purchase of logs from independent suppliers, and (2) cutting operations conducted on forest land owned or controlled by the complex. A 1:1 ratio in quantity of material obtained from these sources will meet the needs of the complex and, at the same time, should stimulate the establishment of a stable market for saw logs. There is considerable evidence to support the conclusion that too heavy a dependence upon open market purchase would result in a failure to obtain sufficient saw logs. Conversely, ownership and control of enough forest land to meet total annual requirements for saw logs would tie up too much capital and impose burdensome commitments upon the complex. Irrespective of the location of the operating site, it is doubtful that enough land could be purchased and/or be brought under control to meet the total requirement for saw logs.

Independent Suppliers of Saw Logs and Cordwood

The encouragement of independent sources of saw logs and cordwood will be very advantageous to the complex. The development of an atmosphere of mutual business respect between log suppliers and the management of the complex will make it possible for the complex to optimize forest ownership, management, and land control. It is probable that saw logs derived from otherwise unavailable stands of merchantable timber could be obtained through the activities of independent loggers. Also, the establishment of a firm saw log market will probably result in numerous farmers and small land owners delivering many valuable individual trees that otherwise would not be cut. This probability is premised upon the resource-

fulness of the native Eastern Kentuckian, manifesting itself in willingness to convert a growing crop into ready cash—provided he arrives at the point of recognizing trees as a crop and feels an assurance of a fair deal at known values.

Whenever possible logs should be delivered to the collection yard in tree lengths. In essence, the reason for this is that bucking to so-called “standard lengths” at point of felling is seldom accomplished to the best advantage of a sawmill. The woodsman who cuts the tree and does the bucking is in the majority of cases absolutely unqualified to determine the length of logs that should be bucked from each tree. He will ordinarily cut individual logs to a convenient length for handling, ignoring the objective of developing maximum log grades.

Logs delivered to the collection yard will be handled individually—each being regarded as valuable raw material. The first step in the continuous preparation operation will be to remove the bark, thereby giving best exposure to any defects that might exist. Next, a skilled log grader will evaluate the product potential of the whole log and have it bucked into lengths most likely to result in extracting the best quality from the log and to assist the subsequent production program of the complex. The log supplier will then be credited and paid for what each log actually yields in rough products. If desired, the supplier could readily follow his logs individually through the barking, grading, and bucking operations.

The policies and procedures advocated above will require an advance educational effort by the complex to enable the log suppliers to recognize the attendant advantages that will be received. While these advantages will accrue in the form of a greater average return from the sale of logs, there may be instances wherein individual logs will bring less return than anticipated by the seller on the basis of his past experiences. A related need will be to establish standardized methods of grade determination that are readily understandable.

All cordwood should be delivered to the complex in standard 100 inch lengths. Payment for material that is delivered will be made in accord with quantity (measured by volume) and species.

Procurement of Rough Products from Company Forests

Contract loggers should be used to harvest trees on company owned or controlled forest

land. This employment would completely exclude the conduct of logging by the complex. Preparatory to logging, responsible staff forestry personnel should mark trees to be cut, and the general regulations that will be included within the terms of logging contracts should be determined. In fairness to the contractor, consideration should be given to the character of terrain, stand density, and other variable factors affecting the cost and efficiency of the logging operation, and the terms of contract should be drawn to allow fully for each.

The management of the complex should plan to advise logging contractors concerning methods of logging compatible with the application of forest management principles. It also should be prepared to assist them in financing purchases (or lease) of equipment, including power saws, road building equipment, tractors, power loaders, and log trucks. Although very little specialized logging equipment is used in eastern Kentucky, the economic advantages to be gained by its use make it almost mandatory that the complex insist upon its application, as well as insisting upon the application of work techniques that save manpower and reduce costs.

Procurement of Lumber

The need to purchase 35,000 board feet of lumber from independent sawmills when the optimum level of operation has been reached will result in a challenging procurement task. Because of the relative inefficiency of sawmills operated by independents, the complex can expect to manufacture lumber for several dollars less per thousand board feet than independents. As a consequence, when purchasing lumber from independents it will be difficult to offer them more than an absolute minimum margin of profit between their production costs and selling price. This would be a prohibitive situation for any independent faced with a need to purchase saw logs at the same price the complex will be required to pay for its logs. It is probable, however, that much of the lumber that will be manufactured by independent sawmills will derive from saw logs cut from forest land that is owned or otherwise available at an advantage to the sawmill operator. In such instances there will be limited regard for the true value of the logs, and the operator will actually sell his labor in the form of lumber. While he may be temporarily satisfied by such an arrangement, the lack of economic soundness of the situation will eventually manifest itself in the failure of the source of supply.

Buying lumber under these circumstances will place the complex in the compromising position of having exploited the sawmill operator. The direct effect of this will be to maintain a suppressed value for lumber, resulting in little more than a continuation of the situation prevailing throughout the region. Since one purpose of this study program is to recommend industrial activity that will improve the economy of the region, this situation must be avoided.

If the complex confines its external purchases of lumber to well manufactured better grades of selected species, it should be able to pay a premium above the going price. The rationalization in this instance is that, although the average price of the lumber processed by the complex will thus be increased, the ability to correlate raw material supplies more closely with product needs will result in a greater overall efficiency of utilization.

A gradual build up of the production activity of the complex will, of course, permit a cautious approach to the problems of outside lumber purchases. Operating experience will develop information as to where, how, and what to purchase to fulfill lumber needs, and how to relate this information to an orderly and profitable procurement program.

It is also certain that the complex will be confronted with the task of assisting would-be suppliers of lumber to manufacture the best possible product. The missionary activities thus required, if handled properly by the management of the complex and if accompanied by rational buying practices, can result in establishing permanent sources that will fulfill all requirements of outside lumber procurement.

Procurement Area

The site to be selected for location of the processing complex will exert a strong influence on the details of raw material procurement. While sites will be treated separately in Section V, it is pertinent at this point to establish a relationship between raw material needs and the ability of the forest resource to satisfy those needs.

The procurement of saw logs and cordwood can logically be confined to an area within a radius of about 50-miles around the complex. This radius of operation has been determined largely by reasonable limits of economic performance; under average circumstances in the region, it will permit deliveries of raw material without excessive transportation costs and it will permit easy administrative

cognizance over the operation. The total amount of forest land within a 50-mile radius of operation, assuming 71 percent of the land to be forested, will be 3,569,858 acres; this amounts to 59.4 percent of the total forest land within eastern Kentucky. There will be 8.8 billion board feet of sawtimber within a 50-mile radius; 150 million board feet of this total will be available annually above the present annual drain of 247 million board feet. The annual saw log requirements of the complex will amount to 5.27 percent of the available annual supply.

It is to be expected that certain raw material requirements will result in limited procurement activity beyond the 50-mile radius. In all probability, a portion of the requirement for rough green lumber will be met in this manner. Also, the demand for select logs purchased specifically for manufacture into specialty products, such as solid wood paneling, can be expected to result in procurement over a larger radius.

Raw Material Transportation

The hauling of tree-length logs, as has been advocated, undoubtedly will meet at first with considerable opposition. It is not a customary means of log transportation in eastern Kentucky, and there are few trucks in the region capable of carrying such a load in a routine manner. Trucks will have to be purchased to do the job, and the complex will have to assist contractors to understand and meet this requirement.

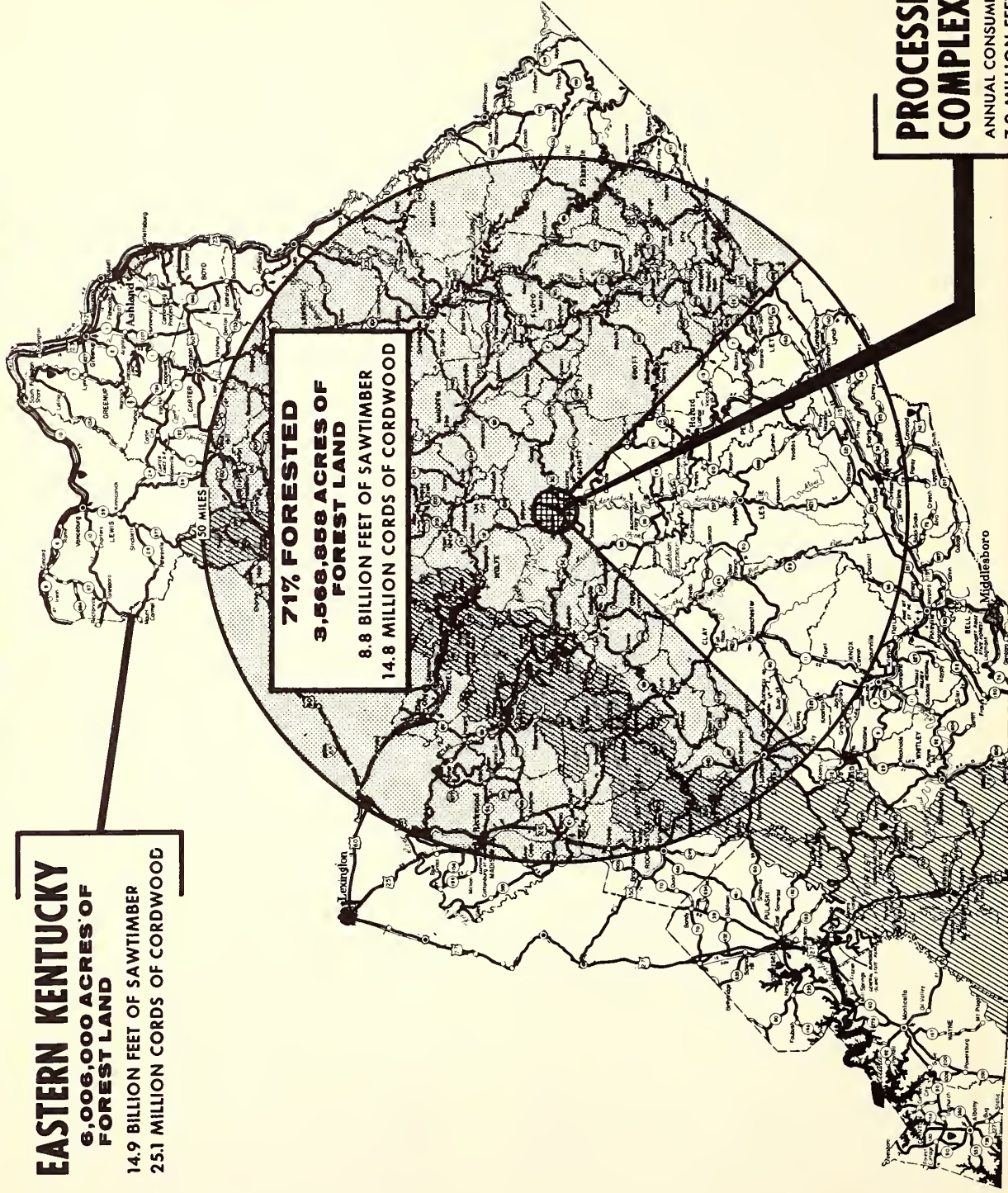
Existing State highway regulations do not bar the use of the special truck and trailer rigs required to transport tree-length logs. Length, width, and weight maximums for trucking are established within limits that can be satisfied without special precautions. Maximum overall length is 50 feet, and the gross weight is 73,280 pounds for vehicle and load. In the event that these limits are likely to be exceeded, the complex will find the Division of Motor Transportation, Kentucky Highway Department, ready to cooperate in providing special permits.

Opportunities will arise for independent operators, confining their activities exclusively to log hauling, to service the requirements for log transportation. The volume of material needed by the complex will be large enough and demand will be steady enough to make a small scale trucking operation an attractive business opportunity. The management of the complex should cooperate in establishing one or more such operations, since the arrangement will be

A TYPICAL 50-MILE PROCUREMENT RADIUS

EASTERN KENTUCKY

**6,006,000 ACRES OF
FOREST LAND**
14.9 BILLION FEET OF SAWTIMBER
25.1 MILLION CORDS OF CORDWOOD



71% FORESTED
**3,568,858 ACRES OF
FOREST LAND**
8.8 BILLION FEET OF SAWTIMBER
14.8 MILLION CORDS OF CORDWOOD

PROCESSING COMPLEX

ANNUAL CONSUMPTION
7.9 MILLION FEET OF SAWLOGS
31,800 CORDS OF CORDWOOD

superior to the alternative of the complex itself owning and operating trucking equipment.

It is estimated that not more than 50 percent of the saw logs required by the complex will be available in tree lengths. The balance will be in shorter length logs that have been bucked in the woods as a result of the need to accommodate the character of individual trees. Some hardwoods, for example, have growth patterns that frequently will make it impossible to yield a tree-length log. This will make it necessary to have available two types of trucking equipment: one for short logs and one for long logs. The relative requirement for each type of equipment is difficult to predict and should be worked out in accord with experience during the initial build-up in activity of the complex.

The transportation of saw logs accounts for only 29 percent of the tonnage of wood raw material movement into the complex. Deliveries of rough green lumber from independent sawmills will account for another 13 percent. It is expected that the lumber will be trucked by the various sawmills without generating transportation problems for the complex. The remaining 58 percent of the incoming tonnage will be in the form of cordwood; part of this will derive from logging operations directed by the complex and part will be in the form of deliveries by independent operators. The overall size of the trucking job involved in supplying the complex its daily raw material requirements is suggested by Table II-IV.

TABLE II-IV DAILY DELIVERIES OF RAW MATERIAL TO THE COMPLEX (at optimum operating capacity)			
RAW MATERIAL	QUANTITY	UNIT WEIGHT (green) ^{1/}	APPROXIMATE DAILY WEIGHT
Saw Logs	31,500 bf	10,800#/Mb	180 tons
Cordwood	127 cords	5,390#/cord	342 tons
Lumber	35,000 bf	4,400#/Mb	77 tons

^{1/} based on average Appalachian hardwood species; logs @ 80% moisture content value and lumber @ 65% moisture content value.

Raw Material Preparation

As previously explained, saw logs will be debarked soon after delivery to the collection yard and will then be bucked to length and sorted into end-use and species groups. Following these operations, their routing will depend upon a variety of factors including the time of year, processing needs, log

grade, and species. However, any portion of a log that does not qualify for sawmill breakdown will proceed by conveyor directly from the bucking station to a whole-log chipper. Chips produced by this operation will be carried by a high pressure pneumatic transfer system to a chip-car loading station.

Since different species of trees are best logged at varying times of the year, it will be necessary to maintain reasonable inventories of saw logs as a means of distributing the species over an extended operating period. In general, fall, winter, and early spring are the best times of the year for logging; these will be the times for inventory building. Optimum inventory cannot be predicted accurately but must be based on experience and related to the market for finished products. The total yard inventory of saw logs may logically be in the neighborhood of 1.5 to 2.0 million feet, equivalent to a 45 to 60 day supply of the sawmill at full operating capacity. Too large an inventory will result in deterioration of logs, while too small an inventory will invoke operational handicaps.

In order to limit the drying out of logs during storage—a particular cause of splits and checks in debarked logs—water can be sprayed over storage piles during periods of dry weather.

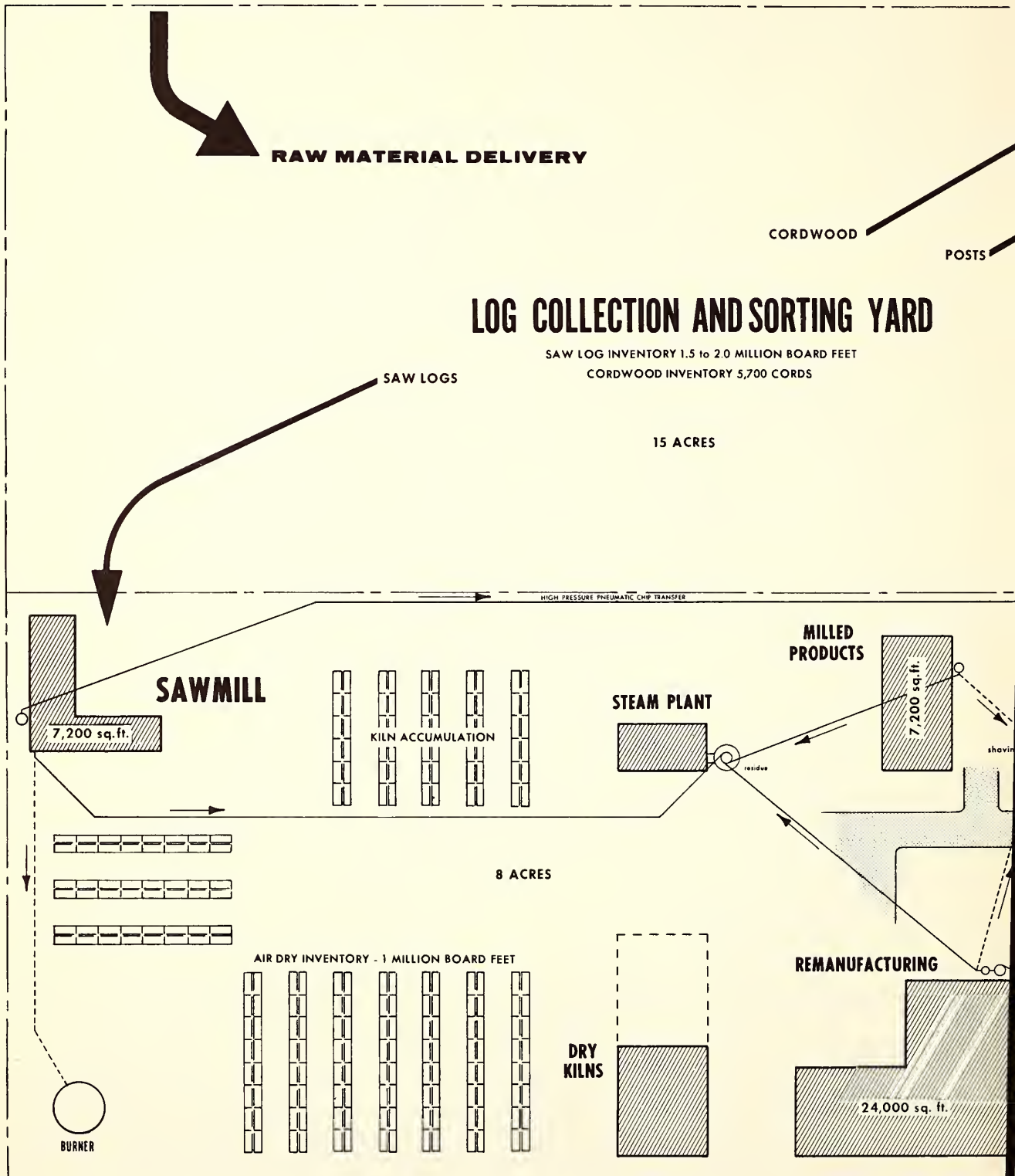
Saw logs should be sorted by species and grade to facilitate the efficient operation of the sawmill. This will be accomplished by fork carrier transfer of debarked logs from the sorting decks to storage areas in the collection yard. Each storage area should be managed on a first-in-first-out basis so as to minimize chances for deterioration.

A limited quantity of the bark removed from logs will be processed into mulch. Because of the large quantities of bark that will be recovered—10.8 dry tons per day from saw logs and 19.7 dry tons per day from cordwood—it will undoubtedly be necessary to dispose of a considerable quantity by burning.

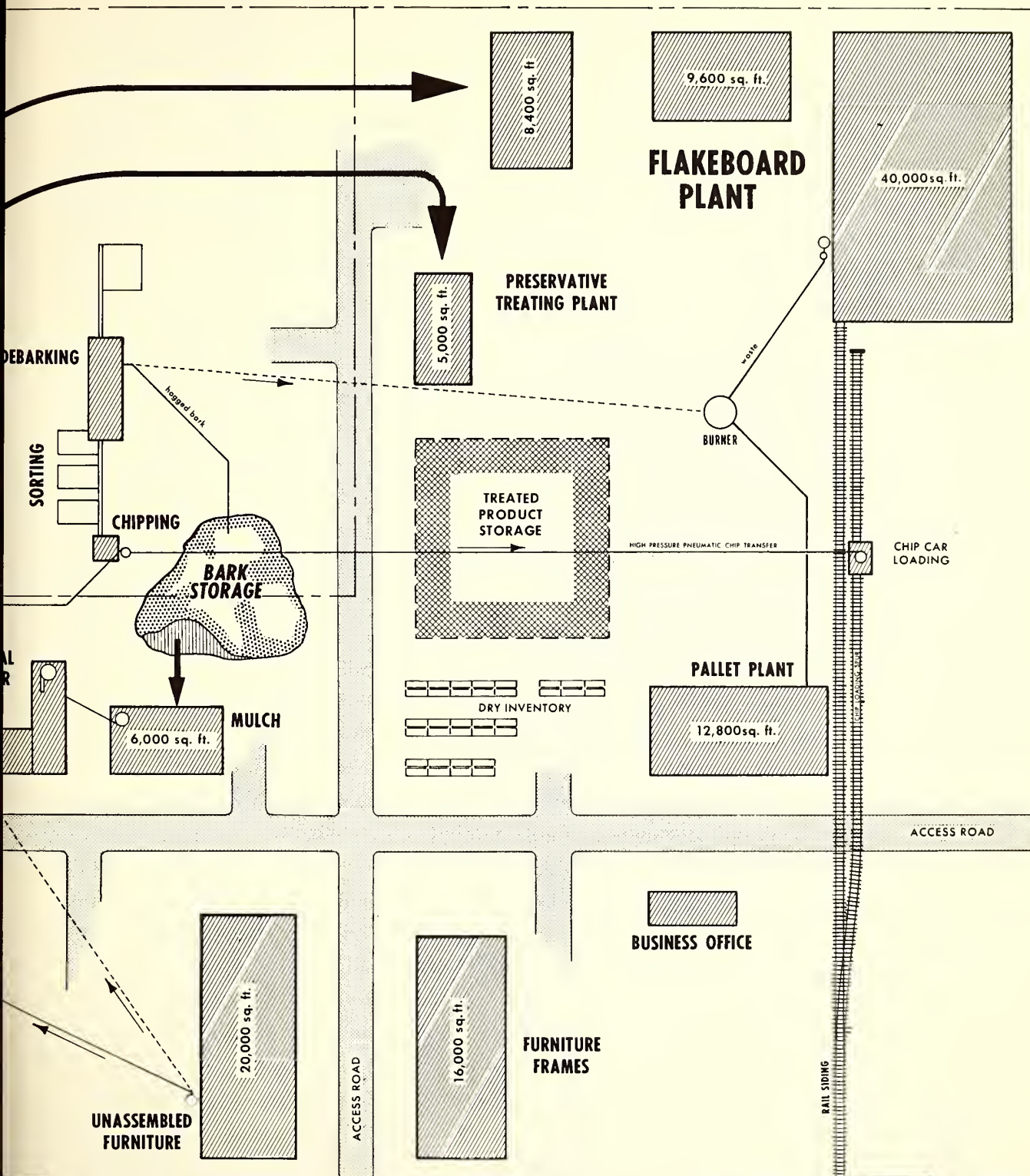
Cordwood for direct conversion into flake-board, plus a limited quantity to be treated with preservatives and sold as fence posts, will be debarked on delivery in a manner identical to the handling of saw logs. Following debarking, the cordwood will be stored; a 45 day supply (5700 cords) is considered an ample reserve.

The collection and storage yard will be operated by five men plus a supervisor-maintenance man. They will include a barker operator; a grader, who will operate a log bucking saw; a sorter, who will direct logs to their proper destination within the

PRELIMINARY PLAN OF

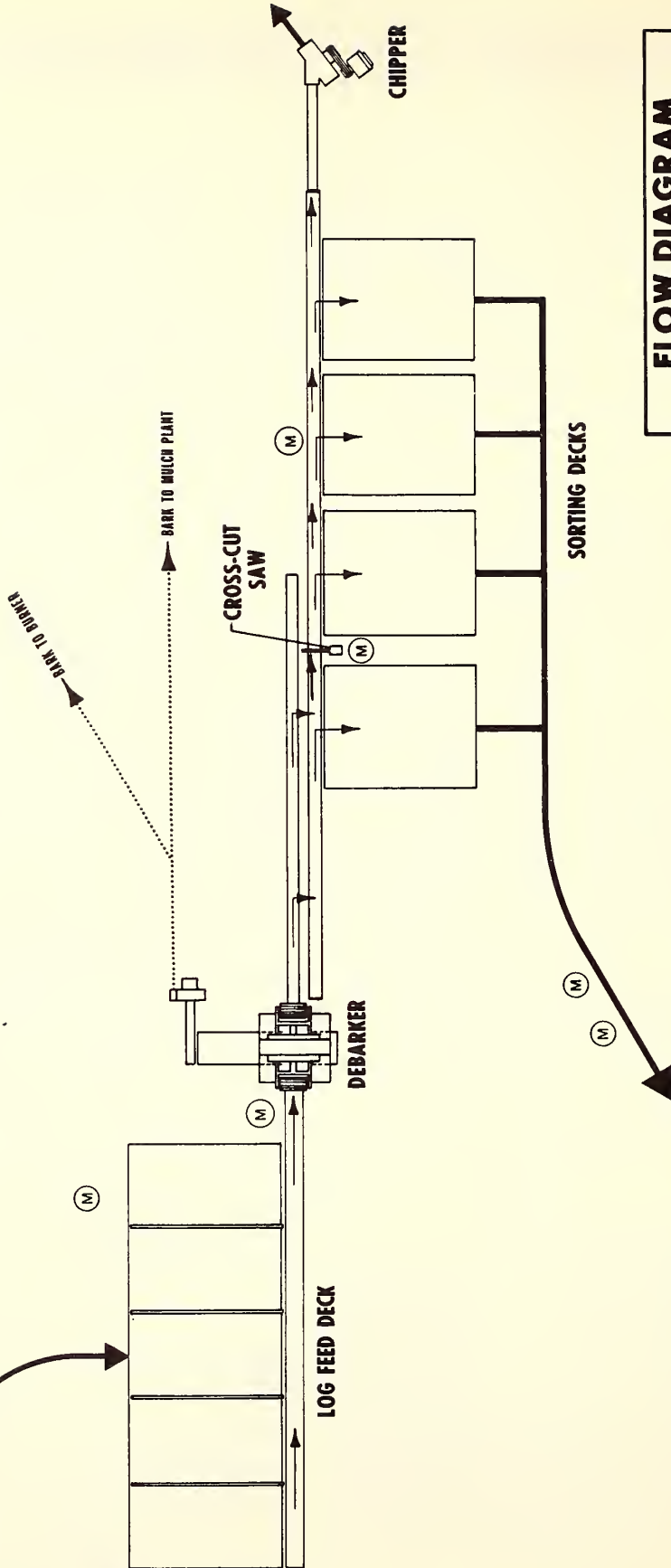


PROCESSING FACILITIES



TO SCALE - TOTAL AREA = 54 ACRES

SAW LOG &
CORDWOOD
DELIVERY



SAW LOG & CORDWOOD STORAGE

(M) = MANPOWER STATIONS

FLOW DIAGRAM

DEBARKING, SIZING & SORTING

MACDONALD ASSOCIATES INCORPORATED
ENGINEERING DIVISION

SCALE	3/8" = 1'	CHECKED	B. M. NO.	REV.
DRAWN		FILE NO.		
DATE	10/17/62	JOB NO.	610	D-6100

yard; and two fork carrier drivers, who will transfer material within the yard and between the yard and processing units.

Physical Arrangement of the Complex

The plan of processing facilities, on page 50, shows a tentative physical arrangement of principal and satellite manufacturing units of the complex. The arrangement is laid out on a 54-acre tract and is presented as a plan that will satisfy the operational requirements of the complex. The plan serves as a visible guide to the approximate building and ground space required for each production activity recommended in the preceding discussions, and it should prove helpful in understanding the physical relationship that will exist between the processing units described in the next section.

The overall complex must be laid out in a manner that will facilitate the achievement of maximum efficiency of operation. The "community" character of the complex presents an ideal opportunity to attain high efficiency. For example, opportunities for dual usage of many pieces of service equipment will arise. A refuse burner serving one processing unit can serve additional units with equal facility; one yard fork lift truck can transfer materials between several different processing units; and a single rail

spur can serve multiple users. An additional benefit to be expected is a reduction of overhead costs because of the application of group fire insurance rates, the use of a single transformer step-down station serving multiple customers with electric energy, and the proration of costs for access roads and water service. The proximity of processing units within the complex will certainly lead to a conservation of effort, compared to the situation that would exist if processing units were at widely scattered locations throughout the facility.

Although certain advantages have already been identified as inherent in the conduct of business in a concentrated industrial community, imaginative thinking will be required to establish the physical arrangement that will best develop these advantages. The more important guide lines to effective planning, which have been applied to the model layout, are: (1) the collection yard should be easily accessible to all units drawing upon the yard for their raw material supplies; (2) each unit within the complex should be provided adequate ground space and building space to permit reasonable growth—this is equally applicable to the total space requirements for the overall complex; (3) each unit should be conveniently accessible to rail and truck service; (4) inter-related operations should be located close to each other to facilitate efficient transfer of materials; and (5) each unit should be designed to maximize both its own operating efficiency and that of the overall complex.

Section III

Processing Facilities

Manufacture of Green Lumber

The lumber manufactured by sawmill conversion of logs is the basic product required for nearly all subsequent processing activities of the complex. Of necessity, the function of sawmilling must be performed in a highly efficient manner; and, more importantly, it must be an economic operation. The mechanics of converting saw logs into lumber are relatively simple, but it is difficult to accomplish conversion with a finesse that will result in maximum economic advantage.

As part of an integrated complex, the sawmill will gain a dual advantage. Because it can order its raw material from the collection yard in the form of debarked, graded, and sorted saw logs, it will be freed from the problem, common to many sawmills, of working with an uncertain mixture of logs of various grades and species. At the input end, it will have working for its benefit trained forest management personnel and a saw log procurement program planned and executed in a manner that will result in processing advantages. At the opposite end of the production spectrum, it will be favored by exact knowledge of what products its "captive" customers want and the specifications that must be met by these products. Many sawmills manufacturing lumber for sale on the open market have no such advantage; rather, they turn out products in the hope that they will find customers for them.

Saw Logs

Sawmilling starts with an understanding of saw logs, to the extent that it will be possible to develop the maximum grade of lumber from each log. There is no guarantee that a No. 1 grade log will yield better lumber than a No. 2 grade log, nor that a No. 2 grade log will yield better lumber than a No. 3 grade log. The realization of the potential yield of the higher grades of lumber from a given log is the responsibility of the sawyer, assisted by a skillful edgerman and a trimmer man.

The debarking, grading, and sorting of

logs are processing refinements that will assist the sawyer in his task of sizing-up each log for best handling through the saw. The absence of bark reveals defects clearly, and sorting results in preventing radical changes in characteristics from log to log that might confuse the sawyer's judgment. Regardless of the skill of the sawyer, an economic projection of the activity of the sawmill must be predicated on the repeated achievement of average grade distributions in yield of lumber from the various grades of logs. One objective of sawmill management should be to exceed the average yield of better grade lumber; conversely, the failure to achieve average yields will bring about an undesirable economic condition. Since the price paid for saw logs is based upon what the log should yield in lumber, failure to obtain that yield over a period of time would be disastrous.

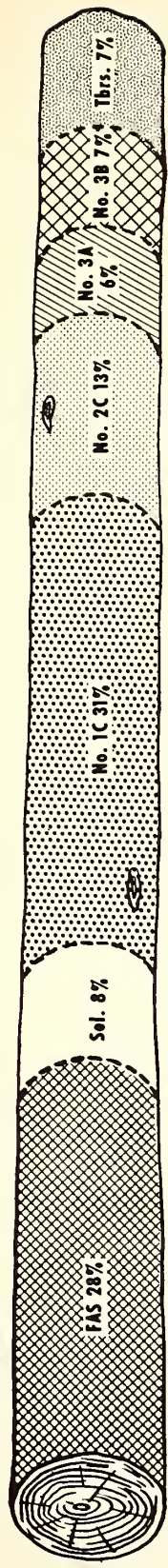
The importance of purchasing logs according to established grade specifications and of extracting the highest possible grades of lumber from each log cannot be over emphasized. Excellent literature is available covering the subject of relationships between logs and lumber grades.

Diagram III-I shows the yields in lumber grades that can be expected from established grades of logs. It is important to realize that, on the average, a No. 1 grade log will yield 67 percent No. 1 common and better lumber, a No. 2 grade log, 44 percent, and a No. 3 grade log, 23 percent. When these yields are related to the distribution of saw logs by grade throughout the forests of eastern Kentucky, it is found that the average yield of No. 1 common and better lumber will be 28.5 percent. The only way to increase this yield will be to increase the run of No. 1 and No. 2 logs through the sawmill in proportion to No. 3 grade logs.

Proposed Sawmill

A properly designed modern sawmill able to operate with utmost efficiency is mandatory if the complex is to fulfill its mission of stimulating the economy of the region. An attempt to minimize initial investment in the complex by use of an already installed saw-

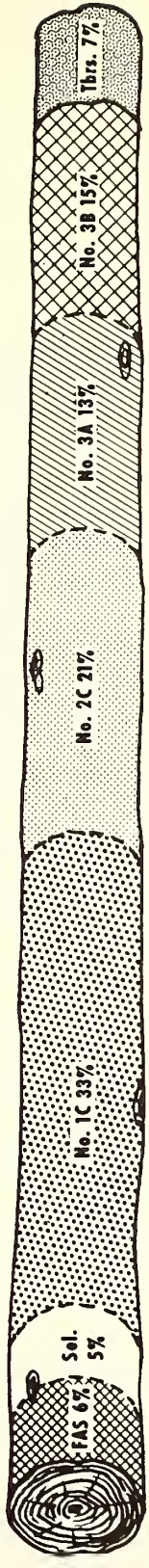
LUMBER YIELDS FROM AVERAGE SAW LOGS



7.3% OF AVAILABLE SAW LOG SUPPLY

AVERAGE DIAMETER 18"

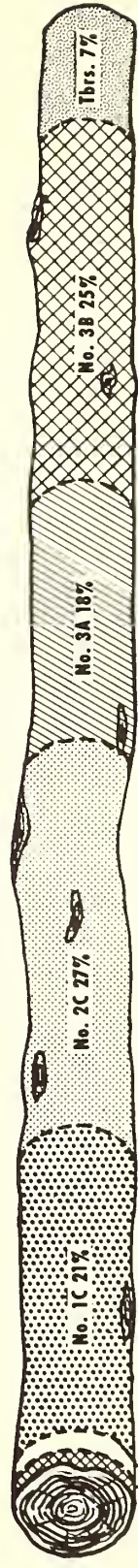
LOG GRADE NO. 1



10.7% OF AVAILABLE SAW LOG SUPPLY

AVERAGE DIAMETER 15"

LOG GRADE NO. 2

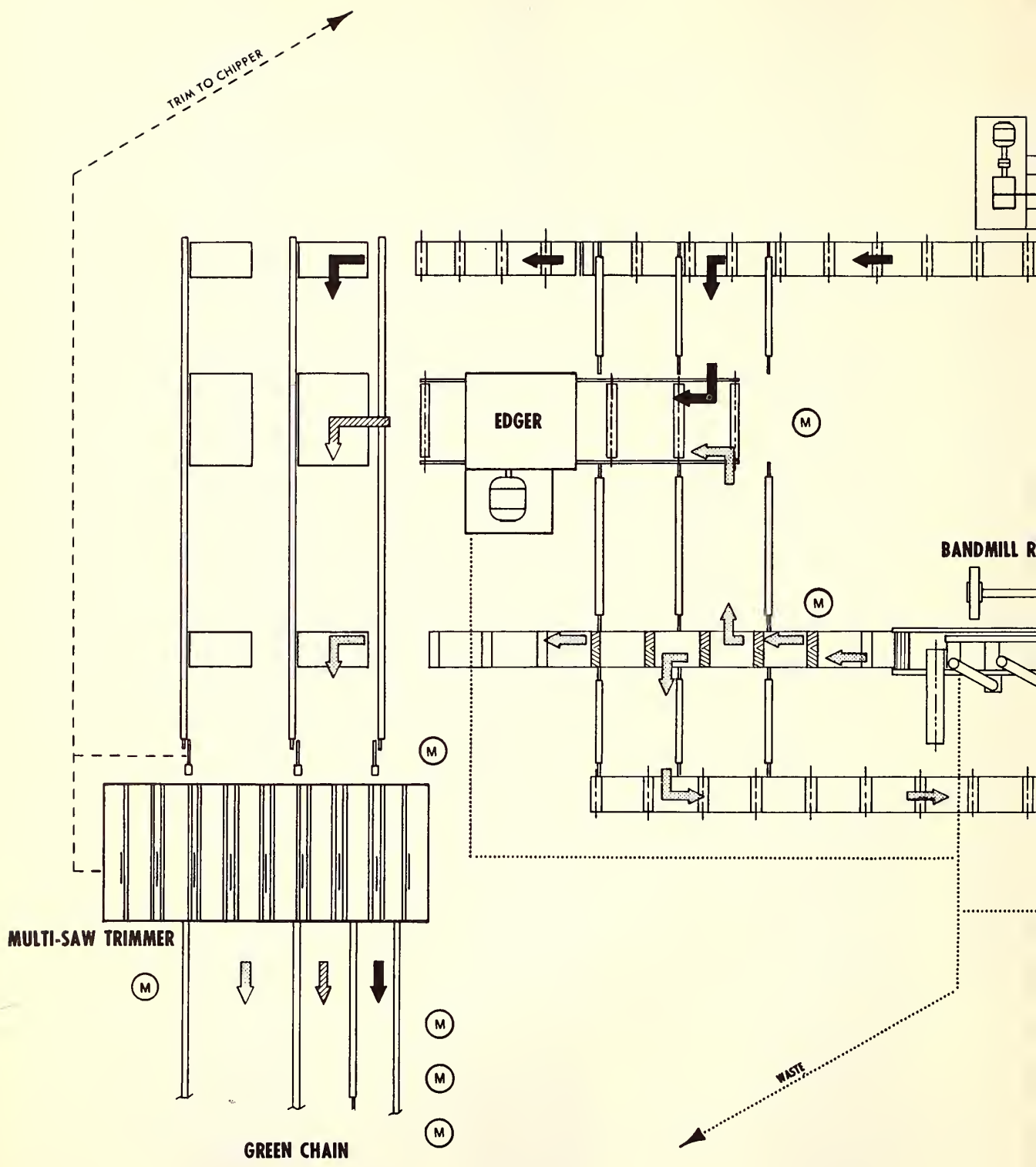


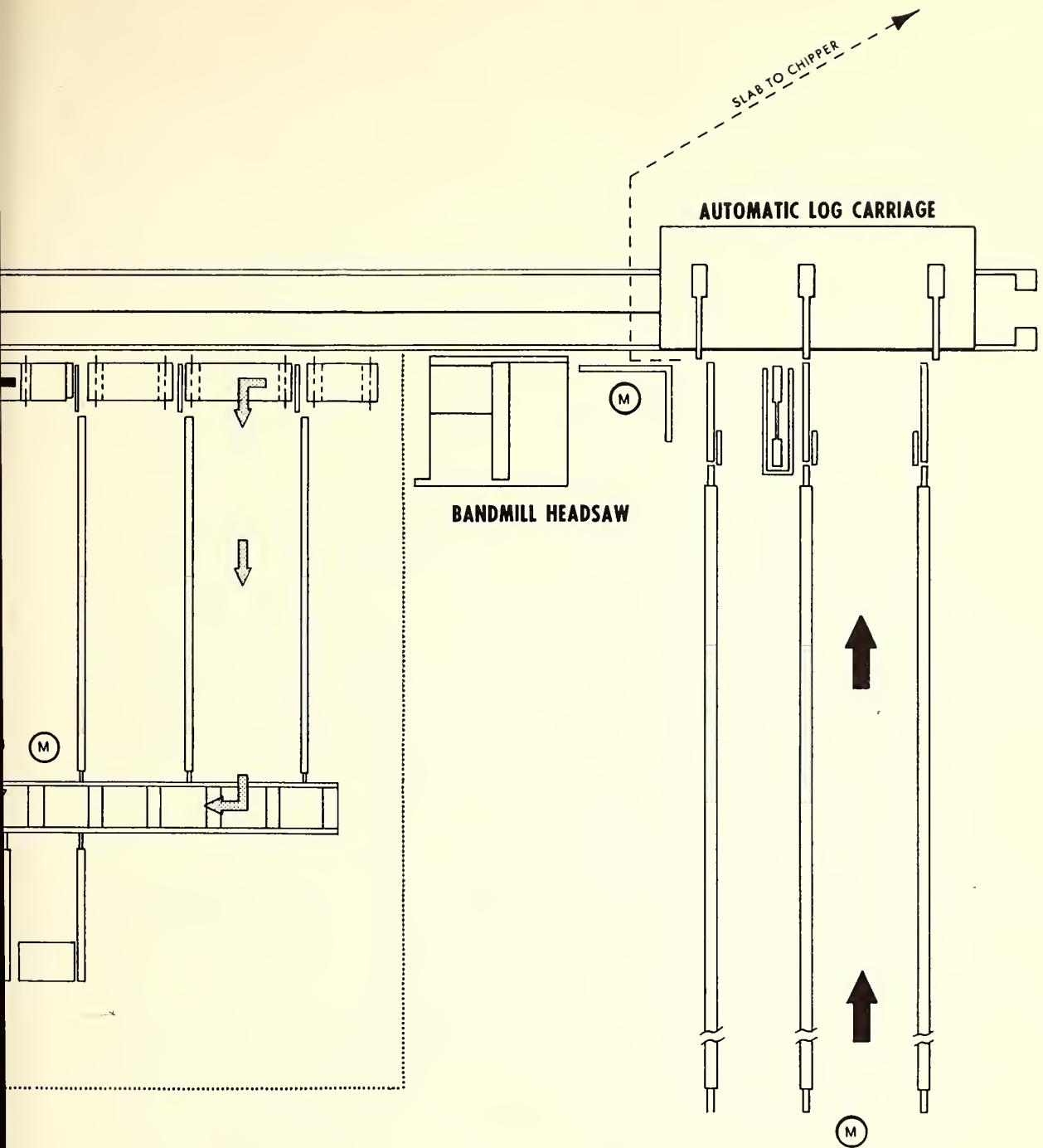
82.0% OF AVAILABLE SAW LOG SUPPLY

AVERAGE DIAMETER 13"

LOG GRADE NO. 3

YIELDS SHOWN ARE FOR LOWLAND RED OAK
AS DETERMINED BY THE U. S. FOREST
PRODUCTS LABORATORY, MADISON, WISC.





FLOW DIAGRAM

SAWMILL
(Operated by Principal Corporation)

MACDONALD ASSOCIATES INCORPORATED
ENGINEERING DIVISION

SCALE 1/8" = 1.0'	CHECKED	B. M. NO.	REV.
DRAWN	FILE NO.	D-6101	
DATE 10/19/62	JOB NO. 610		

MANPOWER STATIONS

mill should be avoided. A non-operative or marginally operating sawmill available for purchase will, in most instances, be available because of inefficient equipment, poor design, or heavy reliance on manpower in lieu of mechanization. An attempt to adapt such a mill to the processing concepts advocated in this report would be a serious error. The design of sawmill machinery and sawmills has undergone radical changes for the better within the very recent past; not to apply these improvements to the contemplated operation would expose it to suppressive competitive forces.

The flow plan of the proposed sawmill is shown by diagram on page 56. The sawmill will use a bandmill headsaw and a bandmill resaw with a linebar feed. This combination of machinery is a highly flexible one which can be used to produce either high grade lumber or large quantities of low grade lumber. The resaw has a "merry-go-round" system which permits it to cut up large cants or slabs without interfering with the operation of the headsaw. Ample storage space at the resaw permits stockpiling of cants or slabs when a run of low grade logs is scheduled. An edger and a multi-saw trimmer, at the back end of the mill, complete the manufacturing machinery.

Logs will be supplied to an automatic log infeed system by a yard fork lift carrier. The same carrier can perform other functions within the log collection yard, thus insuring that it will be in full time use. Deliveries should be scheduled so as to permit the sawmill to operate with like species and comparable grades of logs for as extended a period as is possible.

The actual methods of cutting applied to various types of material may vary to a considerable extent. As an example, logs best suited for conversion into lumber that will subsequently be remanufactured into core stock can be cut into cants, without particular regard for grade development. The reduction of these cants into 4/4-inch lumber would take place on the linebar resaw. This method of handling will result in high volume production. On the other hand, in sawing a run of Number 1 grade logs, it is essential that careful attention be applied by the sawyer to the development of grade cut lumber.

It is expected that by far the largest proportion of lumber to be manufactured will be 4/4 stock. There is a possibility, however, that the internal requirements for the lumber will provide opportunities to cut scant in thickness. If this situation occurs, and efforts should be directed toward making it

occur, the volume of overrun between log scale and lumber scale could be appreciably increased.

Solid wood sawmill residue, in the forms of slabs, edgings, and end trim, will be free of bark, allowing all of it to be routed directly to a chipper for conversion into pulp chips. Chips will be conveyed from the sawmill by means of a high pressure pneumatic transfer system to a screening station located in the log collection yard. The screening station will be located adjacent to the debarking-bucking-sorting equipment and will also serve to screen chips manufactured from round-wood not suitable for saw logs.

Special attention will be given to retrieving the solid wood residue developed during the sawing of poplar, basswood, and magnolia logs. This can be provided for by installation of a waste conveyor system that will permit selective by-passing of the chipper whenever these species are being run. A cross-cut saw will be required to cut long pieces of slab and edgings into shorter lengths for ease of handling. Next, the material can be accumulated in large box pallets for transfer to the flakeboard plant, where it will be used as a raw material for the manufacture of flakes. The recovery operation will probably require an additional man whenever the desired species are being run by the sawmill. The amount of material involved is too small and sawing of the desired species will be too irregular to justify installation of an expensive automatic recovery system.

Sawdust will be separated mechanically from the solid residue by the waste conveyor system and will then be carried by a low pressure blower system directly to the steam plant or to a waste burner.

The manufactured lumber will be graded on the green chain after it leaves the trimmer. Following grading, the lumber will be manually pulled and placed in piles according to the sorting and grading requirements established in compliance with the needs of subsequent processing operations.

Manpower Requirements

A total of 11 men, or 10 men if the resaw tailer is eliminated, will be required for the sawmill which will operate for an effective 7.5 productive hours during each eight hour operating day. The normal work week will be five days, with a two man maintenance crew working during the sixth day. Manpower stations and job descriptions are as follows:

1. *Yard Carrier Operator*: Delivers logs to the mill and moves lumber packages to the stacker.
2. *Sawyer*: Loads and turns logs mechanically; makes decisions on sawing schedule for each log and saws; routes sawn pieces to resaw, edger, or trimmer by means of automatic conveyors.
3. *Resaw Operator*: Feeds resaw; makes decisions on face and thickness on each piece sawn, sets linebar; routes pieces to merry-go-round return, edger, or trimmer by means of automatic conveyors.
4. *Resaw Tailer*: Disposes of large slabs and slivers from resaw; helps resaw operator route pieces. (This man may be unnecessary, depending on the log sizes and shapes.)
5. *Edgerman*: Feeds edger from headrig and offbearing rolls and resaw; makes decision on width sawing of each piece.
6. *Trimmer Operator*: Feeds trimmer, disposes of long edgings and resaw slabs; makes decisions as to final length of pieces and trims out defects.
7. *Lumber Grader*: Grades each piece of lumber by marking it as it passes on the green chain.
8. *Lumber Pilers (3)*: Pull the lumber from the green chain and pile it into packages.
9. *Foreman-Maintenance Man*: Supervises the crew and carries out preventive maintenance program; makes minor repairs.

Approximate Installed Cost of Sawmill

The estimated cost of the described sawmill, complete with building, is \$275,000. Expenditures necessary for electric power supply, water, a slab chipper, yard equipment, a waste burner, and a high pressure penumatic chip transfer system would bring the total investment to an estimated \$336,000.

Lumber Drying

The complex will not sell green lumber or manufacture products from green lumber. Consequently, the total sawmill production of 35,000 board feet per day will be either air dried or kiln dried. The technical requirements of drying lumber will reflect on the manner of sorting lumber at the green chain. Species must be segregated with regard to their drying characteristics as well as to product applications, as has been mentioned previously. Moreover, when subjected to kiln drying, certain species have character-

istics that make it desirable to separate heartwood from sapwood if economic drying schedules are to be followed. Discussion of these technicalities is not a part of this report, but their influence on facilities and plant investment must be considered.

To permit logical planning, it will be assumed that 50 percent of the total lumber production (most of it oak) will be air dried for 90 days before kiln drying. This requires an air-yard inventory capacity of about one million board feet of lumber; this lumber will be completely replaced four times a year. The balance of the material will be accumulated over a period of up to ten days preparatory to kiln drying, assuming the average kiln cycle to be ten days. A ten day kiln charge will be equal to a sawmill output of 7.14+ working days (250,000 board feet of rough green lumber) since the kilns will operate for 350 days per year, less open time for loading and discharging.

The sorted lumber from the green chain of the sawmill will be moved by fork lift carrier to an automatic stacking machine that will form it into stickered packages of lumber suitable for drying requirements. These packages will measure 16 feet in length, 6 feet in width, and 5 feet in height; they will have 30 layers each of 4/4-inch lumber. Depending upon the type and grade of lumber in the packages, they will be moved by fork lift carrier either to the air drying yard or to the kiln-ready yard area; they will be stacked in position three packages high, with two stacks back-to-back and in rows suited to the yard layout. The air drying yard should be carefully designed and laid out so as to assure proper air movement through the piles of drying lumber.

The kilns should be of the latest prefabricated package type, loaded and discharged by fork carrier. Dependent upon detailed planning of the complex, a final decision can be made with regard to the type of kiln structure. Each kiln ideally should hold 24 packages of lumber, or a total of 50,000 board feet. Five kilns of this size will be required to handle the output of the sawmill; an equal number will be required to dry the lumber that will be purchased from outside sources.

The kilns should be heated by high pressure steam at 100 pounds per square inch. Although the use of wood residue material as boiler fuel has disadvantages associated with it, the large quantities of residue available as a result of the processing activities of the complex cannot be logically disposed of by other means. The capital

investment required to install a wood fired steam plant of the size needed will be considerably higher than for the same steam capacity using natural gas or oil as fuel. Also, the wood fired steam plant will, in satisfaction of state laws, require employment of additional personnel as boiler tenders. Automatic gas or oil fired boilers can be left unattended, but a wood fired boiler requires one or more operators present at all times.

Routing of Dry Lumber

Diagram II-V, provides a concise summary of the routing of both air dried and kiln dried lumber through the complex. This routing must be facilitated by proper scheduling of species and quality of material through the drying operation. One objective of the management throughout the operation of the complex should be to avoid all but an essential inventory of in-process material. Very close coordination between the sawmill lumber-drying operation and each of the processing units using dry lumber as its raw material will be required to accomplish this objective. The satellite units will be particularly dependent upon a smooth in-flow of raw material from the manufacturing facilities of the principal corporation. It is recommended that the principal corporation maintain the major inventory; the logical location for this inventory is the log collection yard, where the raw material will remain in the form of saw logs—prior to the addition of labor and overhead involved in the conversion of logs into dry lumber.

SOURCE	TYPE OF RESIDUE	QUANTITY (dry tons/day)	BEST USE
Collection-Yard	bark	22.5	fuel
	bark	8.0	mulch
	reject logs	6.0	chips
Sawmill	sawdust	9.7	fuel
	solid green wood	19.0	chips
Remanufacturing	hogged solid wood	14.0	fuel
	machining residue	7.0	fuel
	shavings	9.0	litter
Milled-Products	shavings	2.5	litter
Pallet-Manufacture	hogged solid wood	5.3	fuel
	shavings	1.5	litter
Unassembled-Furniture	shavings	0.8	litter
	machining residue	0.6	fuel
Upholstered-Furniture	shavings	0.7	litter
	machining residue	0.8	fuel

Based on Table III-I, the production of residue materials used to best advantage as boiler fuel amounts to 60 dry tons per day, or 1500 dry tons per 250 day operating year. The demand for steam by the dry kilns will total 500 boiler horsepower per hour. To produce this quantity of steam will require the consumption of 39.2 tons of dry wood residue per 24 hour day, or 13,720 tons per 350 day operating year. The surplus of manufacturing residue above the amount required to produce the necessary quantity of steam will total 1280 dry tons per year. This surplus will have to be disposed of; the alternative to using residue as fuel is to burn it as waste.

This report leaves as optional the decision of whether to make a comparatively high capital expenditure and install a wood fired steam plant, or to minimize investment and increase daily operating expenses; estimated at \$200 more per day if oil is used instead of residue. The wood fired steam plant would involve additional capital expenditure estimated at \$80,000.

Manpower Requirements

Seven men and a superintendent will be required to run the air yard and kilns during the five day week that the sawmill and other processing units of the complex are operating. Only two men will be required during the remaining two days of each week. Manpower stations and job descriptions are as follows:

1. *Stacker Operator*: Operates automatic stacking equipment, marks each stack for identification, and routes stacks to their appropriate drying stations.
2. *Stacker Helper*: Assists in stacking operation.
3. *Yard Carrier Operators (3)*: Deliver stacks of lumber to appropriate drying stations, charge kilns, discharge kilns, deliver dry lumber to destinations within the complex, and receive green lumber delivered by independent suppliers. These operators will work staggered shifts to the extent that one man will be on duty during weekends.
4. *Kiln Operator*: Responsible for proper operation of the dry kilns.
5. *Kiln Operator Assistant*: Assists kiln operator and assumes responsibility for proper operation of the kilns during weekends.
6. *Supervisor-Maintenance Man*: Responsi-

ble for air and kiln drying of all lumber; meets delivery schedules of dry lumber to various processing units; receives deliveries of lumber by independent sawmills; performs preventive maintenance.

Installed Cost of Air and Kiln Drying Facilities

The estimated cost of equipment for lumber stacking and for facilities required to inventory and handle one million board feet of air drying lumber is \$90,000. The installed dry kiln building and equipment, including a wood fired steam plant, will be \$185,000; the total investment for processing lumber from the sawmill into dry lumber ready for delivery to product manufacturing activities is \$275,000. This estimate includes only 50 percent of the kiln capacity that will eventually be required to dry lumber, including that purchased from independent suppliers. The kiln structure and the steam plant arrangement will be designed to facilitate expansion at some later date. An additional investment of \$175,000 will be required to provide facilities for drying at the rate of 70,000 board feet per day.

Remanufactured Products

Dry lumber, sorted by species and grade prior to drying, will be delivered to the remanufacturing plant of the complex in stickered packages as removed from the kilns. The remanufacturing activity will process 40,000 board feet of dry lumber per day and will require a backlog inventory of approximately 125,000 board feet of lumber under protected storage. The purpose of this inventory will be to smooth out the irregular flow of lumber from the dry kilns, caused by the differences between a five day manufacturing week and a seven day drying week. The inventory will also serve to facilitate scheduling of like species and grades of lumber through various processing activities.

Rough Product Manufacture

The first step in the conversion of lumber into processed products will be rough sizing to remove obvious defective areas from each board. A full description of the procedures involved in accomplishing this is not neces-

sary at this time; it is sufficient to establish as the objective the removal of knots and other defects and the development of the greatest possible quantity of clear wood in the largest possible pieces. This objective can only be accomplished by a mechanized system, operated and supervised by capable individuals having clear knowledge of the importance of their every decision and action.

The flow diagram of the remanufacturing plant on page 64 shows the requisite machining operations and operator stations required for rough product manufacture. The layout is based on an advanced concept of efficient production means designed to accomplish the greatest upgrading of the rough lumber material. The arrangement shown has a capacity of 20,000 board feet per eight hour operating day. Maximum capacity would be 60,000 board feet for a 24 hour period.

The first function, that of unstacking the stickered piles of lumber and feeding it into the production system, is accomplished by a completely automatic machine supplied with fresh material by fork truck. When individual boards reach one of the three cross-cut stations, the operators judge each piece and cut it selectively—both to remove defects and to satisfy orders for material of specified length. According to one authoritative source, each cut-off station can process 7500 board feet of stock per eight hour shift. Material that has been cut for length is next ripped lengthwise to eliminate defects not removed by cross cutting. The two operations serve to provide blanks of rough dimension that will be refined to a greater extent by other operations that follow in the system.

Material rejected during cross cutting and initial rip sawing will be hogged and blown to a refuse burner. The amount of reject material to be disposed of can be determined only on the basis of experience. Once determined, it should be possible to establish an accurate figure for average yield. A 25 percent loss in footage due to reject is the arbitrary figure applied for purposes of the economic projections made in this report. This means that 20,000 board feet of lumber fed into the system will provide 15,000 board feet net output in the form of rough products.

Following the initial ripping operation, the pieces will be surfaced on one side to give an accurate plane of reference for the next processing step: glue-line ripping. There will be four ripping stations, each working to cut each piece into its optimum width, with edges suitable in quality to be used as glue joints. Following hand-pick sorting from a

turntable sorter, the output of these operating steps will be semi-processed raw material for core stock, dimension products, and products to be manufactured by satellite units.

Management programming can be applied to minimize the product mix during any one production run. As an example, raw material for core stock may be prepared to order during a full 4-hour shift, followed by sizing to meet a two or three day run of some other rough dimension product.

Manpower Requirements

The rough mill will employ a total of 13 men for each eight hour operating shift: seven machine operators, three sorters, two fork lift drivers, and a foreman-maintenance man. This unit is expected to operate for two shifts per day when the complex is performing at optimum capacity. Manpower stations and job descriptions are as follows:

1. *Fork Lift Drivers*: Operate fork lifts to supply packages of stickered dry lumber to the unstacker; maintain control of lumber inventory; and service production lines of all remanufacturing activities to assist proper materials flow.
2. *Cross-cut Operators (3)*: Selectively cut rough dry lumber to develop best sound-face yield and to meet customer orders for length of stock. Reject defective material.
3. *Primary Rip Saw Operator*: Rip saws stock delivered from cross-cut stations to remove defect areas limited to only a portion of the piece; rejects defective material.
4. *Finish Rip Saw Operators (4)*: Rip saw presized pieces that have been single surfaced to permit making an accurate glue-line cut; rip saw core stock material to predetermined width to meet technical product requirements for limiting internal stresses; and cut stock to best yield as related to production orders.
5. *Sorters (3)*: Sort the various lengths and widths of stock in accord with requirements for follow-up manufacturing; accumulate separated material on pallets; transfer loaded pallets by fork carrier to the next remanufacturing operation or to a point of pick-up for transfer to satellite operations.
6. *Foreman-Maintenance Man*: Responsible for proper performance of the entire operation, adjusts machinery, serves as a relief operator, and performs preventive maintenance.

7. *Remanufacturing Superintendent*: Responsible for manufacture of rough products, core stock and dimension; coordinates inter-operation production scheduling; supervises all operations and relates orders for products to processing requirements. This man will perform for one shift only, dividing his time proportionately between the three activities under his control.

Installed Cost of Rough Processing Line

The estimated cost of the equipment to receive, feed, and process 20,000 board feet per operating shift as described above is \$148,000. This amount includes the cost of a hog for reducing reject material to a size suitable for low pressure pneumatic transfer to the steam plant or, alternatively, to facilities for conversion into animal litter.

Core Stock Manufacture

At the rough mill, material to be processed into solid wood core stock will be segregated by species ready for assembly into core panels. The species best suited for core stock are the soft hardwoods—principally yellow poplar. Panels will be assembled to customer order; stock panel sizes will be avoided if at all possible, depending upon the functioning of the marketing corporation. The entire core stock operation will be oriented toward serving the customer with custom made products of the highest possible quality. Without this theme, there would be little justification in undertaking the manufacture of solid wood core stock.

The manufacturing process consists of assembling several strips of solid wood, each approximately two inches in width, into modular panels. The use of unrelated narrow strips will result in virtual elimination in the finished product of internal stresses common to solid wood. Each modular assembly, hand assembled, will be bonded in a high frequency pass-through press. Two assemblers will work as a team, feeding through the press to a finishing operator stationed at the opposite side. The finishing operator receives the bonded panels, routes them through a double surface planer to bring them to final thickness, and then puts them through a sizing saw to trim the panels to desired length and width. Prior to surfacing, any small defects present will be removed and replaced with solid wood plugs

inserted and bonded into position by an automatic plugging machine.

Quality control should be stressed throughout the core stock operation. The recommendation to manufacture solid wood core stock is conditioned by the necessity for obtaining the very top market price for a quality product. The available species justify this approach, and the emphasis during product preparation and product handling should remain in accord with the objective of producing only first quality core stock. It would be highly desirable, but not mandatory, to enclose the core stock operation in a humidity controlled section of the remanufacturing plant. The finished product, packaged in unitized bundles for convenient handling, might also be sealed in a moisture-proof wrap; several such bundles would then be packaged between printed corrugated paperboard covers and held together by steel strapping.

Manpower Requirements

The core stock manufacturing operation will require four operators per eight hour shift. They will be under the supervision of the general superintendent responsible for the entire remanufacturing operation. Manpower stations and job descriptions are as follows:

1. *Panel Assemblers (2)*: Assemble panels from prepared stock delivered to the work station by fork truck; feed and operate the high frequency bonding press.
2. *Panel Finisher*: Routes bonded panels through surfacing and sizing operations; routes defective panels through the automatic plugging machine as required.
3. *Packager*: Receives and prepares finished panels for shipment.

Installed Cost of Core Stock Manufacturing Equipment

The estimated cost of the described production equipment and quality control equipment required for the manufacture of up to 8000 square feet of core stock per eight hour day is \$71,500.

Dimension Products

As in the production of core stock, described above, the rough mill will provide

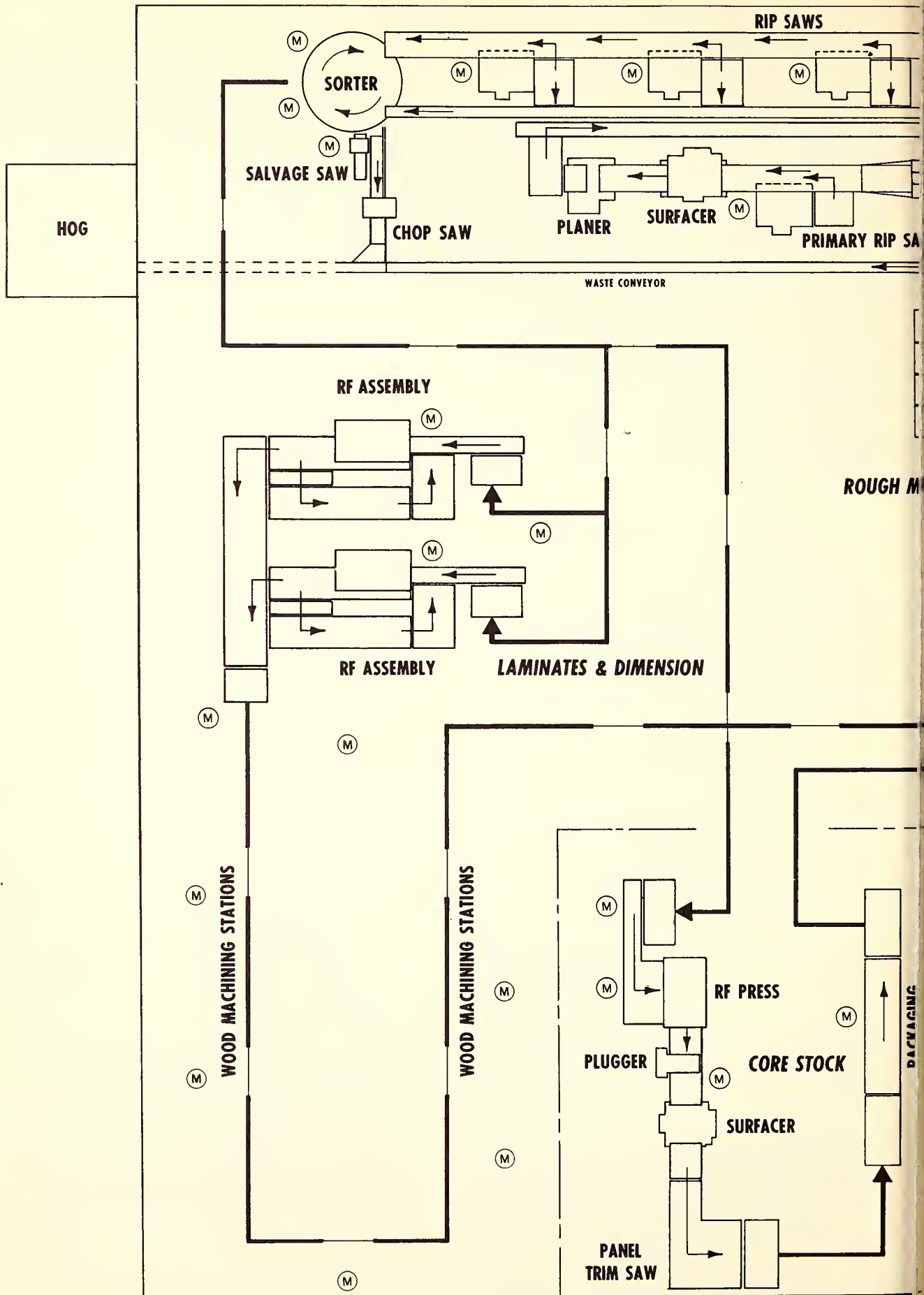
semi-processed material to the dimension operation. Although certain of the products produced by the rough mill could qualify immediately as dimension material, the policy of the complex, apart from sales to satellite units, must be to sell only those products that have been refined to the most advanced point. By adhering to this policy, a better monetary return will be realized for the entire production system. It should be kept in mind that the complex cannot function properly by selling wood per se; rather, it must sell the tangible results of applied labor, management, technical knowledge, and capital investment in the form of products responsive to market demand. With this in mind, it is obviously necessary to process all materials to the optimum point.

Dimension products will include glued laminated products and machined products made specifically to satisfy customer orders. The principle machining operations, apart from sawing, required to meet normal customer needs will be shaping, double surfacing, multiple boring, mortising, routing, jointing, tenoning, and electronic bonding. Insofar as possible, the operation should avoid involvement in the manufacture of heavy laminated structural components and turned products. These products ordinarily involve proportionately more wood than production effort and serve to undermine the policy of the complex, outlined in the preceding paragraph.

Production efficiency is relatively difficult to achieve in a dimension plant, mainly because of performance limitations inherent in wood working machinery. Nevertheless, the competitive standing of the operation will depend upon its ability to approach assembly-line efficiency in its manufacturing activities. Step by step manufacture of parts, which is the conventional production system applied by the dimension industry, should be discarded in favor of a continuous, smooth flow of in-process material from its initial rough form to a finished product. A flexible machine layout, permitting ready repositioning of machines, will facilitate a smooth flow of material through each processing station.

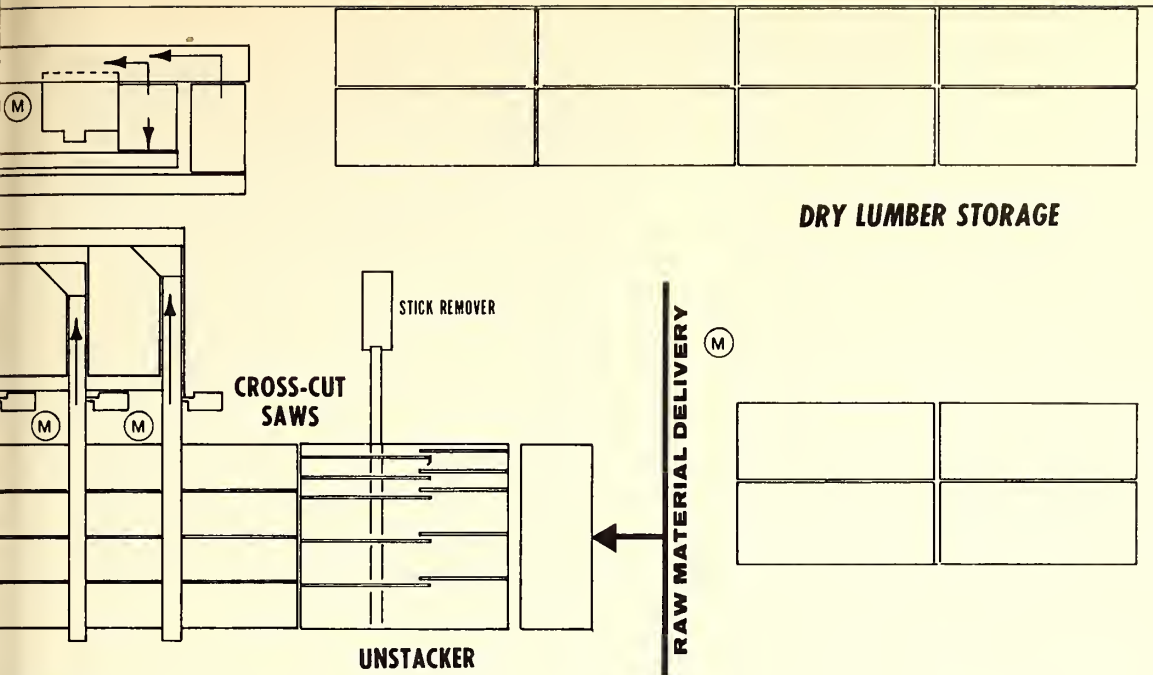
Inventories of in-process material should be held to an absolute minimum, and simultaneous processing of more than a very limited number of products should be avoided. The adoption of these measures will result in intermittent use of some items of machinery; but this situation will be countered by the attendant advantage of more effective application of manpower and reduced overhead costs per unit of output.

All but a very minor portion of the glue



ROUGH M

DAGING



CTURE



SHIPPING

(M) = MANPOWER STATIONS

FLOW DIAGRAM			
REMANUFACTURING PLANT (Operated by Principal Corporation)			
MACDONALD ASSOCIATES INCORPORATED ENGINEERING DIVISION			
SCALE 1/16" = 1.0'	CHECKED	S. M. NO.	REV.
DRAWN	FILE NO.	D-6102	
DATE 11/7/62	JOB NO. 610		

laminated assemblies should be bonded in electronic (RF) presses. Equipment of this type now available will enable greater productivity and reduced production costs as compared to the conventionally applied methods of cold pressing and glue-wheel assembly. The excepted "very minor" portion of the material not processed electronically will comprise assemblies with physical proportions not suited to the application of RF techniques.

The dimension operation will have the advantage of receiving its raw material already sorted to end use requirements by the rough mill. Assuming that glue laminating of smaller pieces into larger components will be required, the first manufacturing procedures will be loose assembly of these pieces preparatory to feeding the assembly through an electronic bonding machine. Following bonding, the panels will be accumulated to permit batch delivery to subsequent wood machining operations; surfacing, jointing, shaping, sizing, and boring. These operations completed, the product will be ready for packaging and shipping.

An estimated 50 percent of the raw material will be subject to machining operations only; no laminating will be involved. Under these circumstances, the electronic bonding stations will be by-passed.

All products, except those manufactured for satellite production units, should be identified by a manufacturers brand mark and packaged in suitable containers. As with core stock, the products would benefit through application of humidity control in the production area; and the products could be packaged in moisture resistant wrapping to assure delivery at a controlled moisture content value. The emphasis should be on the exclusive manufacture of high quality products.

The processing loss during the manufacture of rough stock into dimension products has been arbitrarily established at 20 percent; a gross input of 20,000 board feet will, therefore, yield a net output of 16,000 board feet in the form of finished products.

Manpower Requirements

The dimension manufacturing unit will require nine operators and a foreman per eight hour shift. They will be under the authority of the general supervisor of the entire remanufacturing operation. Manpower stations and job descriptions are as follows:

1. *Stock Feed Man*: Receives stock from

rough product plant and maintains flow of raw materials to proper work stations. He will be assisted by the fork lift operators attached to the rough product plant and, as required, will drive a fork lift carrier to accomplish proper movement of materials.

2. *RF Bonding Line Operators (2)*: Assemble rough sized material and feed into RF bonding machine; when required, build width of assembly by recirculating through the machine until the desired product size has been developed; man wood machining equipment when laminating is not required.
3. *Machine Operators (5)*: Man various wood working machining operations, including: surfacing, jointing, boring, shaping, sizing and sanding.
4. *Foreman-Maintenance Man*: Responsible for proper performance of the entire operation under the direct supervision of the general supervisor of the remanufacturing plant; assigns machine operators to their specific performances; carries out coordination of materials movement; and assists in machine set-ups. Performs limited preventative maintenance.
5. *Packager*: Packages finished products as required and routes to shipping point or other destination; remains available for assignment to production activities whenever deemed advisable.

Installed Cost of Dimension Product Manufacturing Equipment

The estimated cost of the described processing equipment and quality control equipment required for the manufacture of finished dimension products at an equivalent quantity of 16,000 board feet of lumber per day is \$170,000.

Solid Wood Paneling (Milled Products Plant)

The machinery required to manufacture solid wood paneling can be applied in part to the manufacture of other milled wood products. This fact can be taken advantage of by the management of the complex, but it has been intentionally disregarded in developing this initial plan of operation. Recognition is given to the potential, however, by designating the processing unit a milled products plant.

Specially selected lumber, picked for length, width, and surface appearance at the saw-mill green chain, will be delivered to the plant directly after completion of kiln drying. The plant will process a minimum of 5000 board feet per day, all 4/4-inch stock, and maintain an inventory of 30,000 board feet of lumber under protected storage. Inventory should be maintained at this level in order to assure a smooth production flow and to permit extended production runs of a single species of wood. The total processing capacity will exceed 5000 board feet by a considerable amount. Nevertheless, it is considered wise to limit projected activity to the quantity of raw material that, by conservative estimate, can be developed from the 70,000 board feet processed daily by the complex.

The principal product will be pre-finished paneling. The machining and other processing operations required for its manufacture are relatively simple and are readily adapted to semi-automatic production, as shown by the flow diagram on the opposite page. The sequence of manufacture will start with manual placement of individual boards onto a conveyor that will feed a planer-matcher. Surfaced and edged paneling produced by this machine will be conveyed directly to a double-end trimmer that will

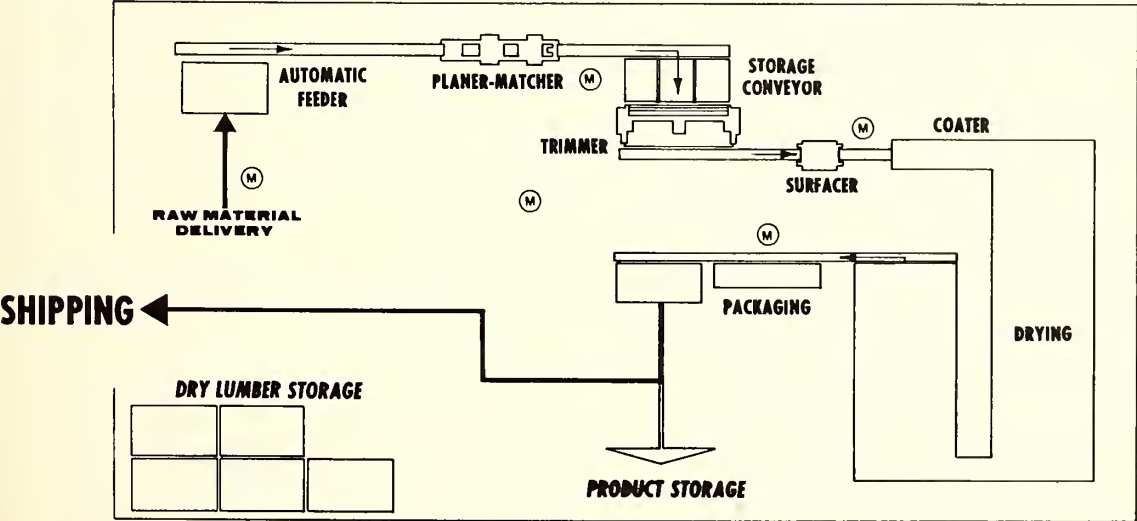
cut it into modular lengths. A manufacturing trade mark can be applied to the trimmed ends during this operation. After trimming, the in-process product will be discharged onto an accumulating conveyor that will feed a single surface sander. The sander will prepare the face of the panel for finishing. Finishing preceded by air dusting, will be accomplished by an automatic coating and drying machine.

An operator stationed at the off-bearing end of the dryer will receive and bundle the completely manufactured paneling (6 to 8 panels per bundle). Alternate pieces will be bundled face to face, with wax paper separators between. Bundles should be packaged in attractively printed corrugated paper boxes.

Manpower Requirements

The solid wood panel manufacturing unit will require four operators and one supervisor-maintenance man per eight hour operating shift. Manpower stations and job descriptions are as follows:

- 1. *Stock Control Man/Fork Lift Driver:*
Procures stock and feeds surfacer infeed conveyor with properly sorted and



(M) = MANPOWER STATIONS

FLOW DIAGRAM				
SOLID WOOD PANELING PLANT (Operated by Principal Corporation)				
MACDONALD ASSOCIATES INCORPORATED				
ENGINEERING DIVISION				
SCALE 1/16" = 1.0'	CHECKED	S. M. HO	REV.	
DRAWN	FILE NO.	D-6103		
DATE 11/13/62	JOB NO. 610			

selected rough dry stock; operates fork lift in raw material inventory area; assists materials and product movement throughout the entire plant.

2. *Planer-Matcher/Trimmer Operator*: Operates, adjusts, and maintains planer-matcher; oversees end trim saw; operates and oversees panel storage conveyor.
3. *Sander/Coater Operator*: Operates, adjusts and maintains sander, panel coater, and panel dryer.
4. *Packaging Operator*: Assists in operation of panel coater and dryer, accumulates finished panels in modular bundles, places separating sheet between panel faces, and packages bundled panels.
5. *Supervisor-Maintenance Man*: Responsible for manufacture of paneling, regulates raw material inventory, correlates production scheduling with orders for products and performs preventative maintenance.

Installed Cost of Solid Wood Panel Manufacturing Plant

The estimated cost of the described processing equipment, quality control devices, and packaging facilities required for the manufacture of prefinished panel products is \$90,000.

Flakeboard

The manufacture of flakeboard is particularly recommended because of the unique advantages resulting from the availability of yellow poplar as a raw material and the excellent prospects for profitable sales of flakeboard within a reasonable marketing radius about eastern Kentucky. Yellow poplar is ideally suited to the production of flakeboard, mainly because of its technical characteristics—particularly its superior bondability. Flakeboard manufactured from yellow poplar demonstrates high strength with low density, is readily machined, and has physical characteristics (weight, feel, color, etc.) that commend it to the user.

Product Definition and Construction

Flakeboard is one of a group of products classified as particle board. This group includes, in addition to flakeboard, such diversely identified products as chipboard, splinter board, extruded board, and com-

position board. Fundamentally, all of these products are made by gluing together particles or flakes of whole wood to form a material that has usable properties of strength, appearance, moisture resistance, and other measurable physical characteristics. These properties vary widely with the species of wood, the nature of the particles or flakes, and the quality of the bonding agent used.

The applications of flakeboard require that the product be in the form of panels having the shape, size, and thickness of plywood. In achieving this objective, large presses are used to compress formed mats of flakes and bonding agent into panels measuring 5'x16', or other commercially acceptable size. The design and performance characteristics of the mat forming machine and the press have much to do with the production efficiency and quality of the product. The control of press time, temperature, pressure, and movement is critical; and proper processing requires careful attention to these factors in accord with predetermined schedules.

The ordinary board product, ready for marketing, comprises 7 percent water, 6 percent resin binder, 0.5 percent wax size and 86.5 percent wood material. The 6 percent resin represents approximately 30 percent of the cost of manufacture, whereas the 86.5 percent wood represents about 18 percent of the cost of manufacture. It is apparent from these relationships that machine functions should be as efficient as possible and that processing requires maintaining strict control of all variables. These conditions, to a large extent, dictate an automatic production system equipped with dependable control devices.

The plant recommended in this report will operate within the following production limits:

Board type.....	3-layer or homogeneous flakeboard.
Daily production ($\frac{3}{4}$ " basis).....	67,500 sq. ft.
Standard product density.....	40#/cu. ft.
Maximum product density.....	52#/cu. ft.
Thickness range of product.....	0.25" to 1.50"

Description of Board Manufacture

Flakeboard is a comparatively new product and as such has undergone a considerable metamorphosis from a rather crude beginning. This applies to the raw materials as well as to the machinery used in product manufacture. There have been several mechanical approaches to board making, and numerous proprietary processes have been developed. At this time, however, mechani-

cal methods have been more or less perfected and are premised on the use of multi-platen presses. Continuous presses and extrusion presses have been phased out for either economic or performance reasons. Proprietary processes, too, are now relatively unimportant for the reason that the knowledge of proper product construction is universally available. There is little reason for a royalty agreement between the engineer or machine supplier and a potential manufacturer.

The design of a profitable plant requires a complete understanding by the designer of both processes and machinery. Such an understanding will assure the most economic approach to the output of products that will find a ready market. Over-mechanization is costly, and a failure to understand fully process requirements limits the ability to control product quality. The ideal plant is that which is mechanically simplified to reduce processing steps, yet is sufficiently automatic to allow manpower requirements to be held at a low level. It is necessary that a particle board plant be operated 3 shifts per day for at least 250 days a year, and preferably, for 300 days a year.

The efficiency of flakeboard manufacture is a function of the proper preparation of the wood raw material, the understanding of and exact control over process variables, and the precision conversion of the "rough" pressed product into finished board. The plant flow diagram provided on page 169 shows the machinery layout and the operating stations required by the recommended processing unit. The sequence of processing steps involved in product manufacture will be as follows:

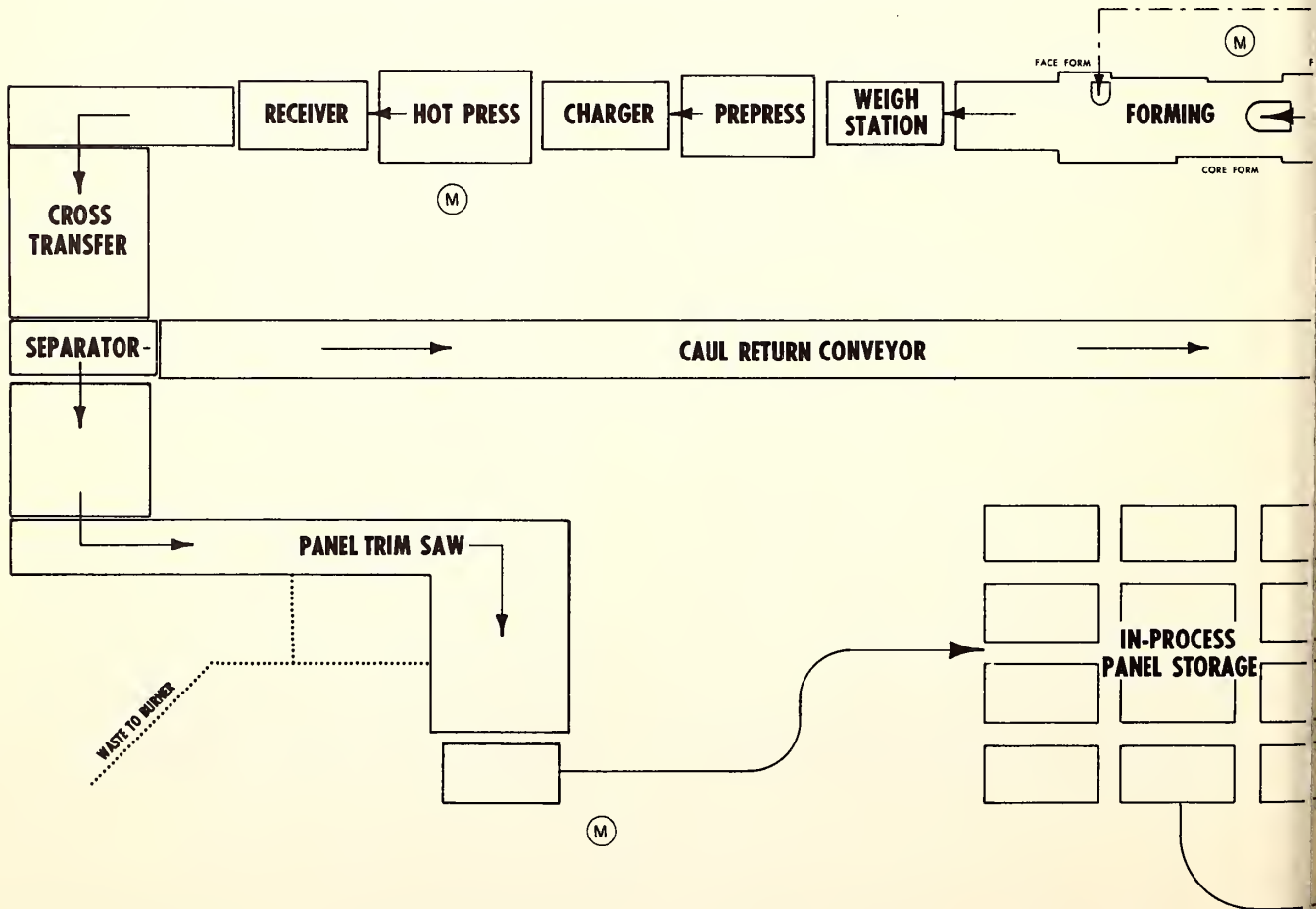
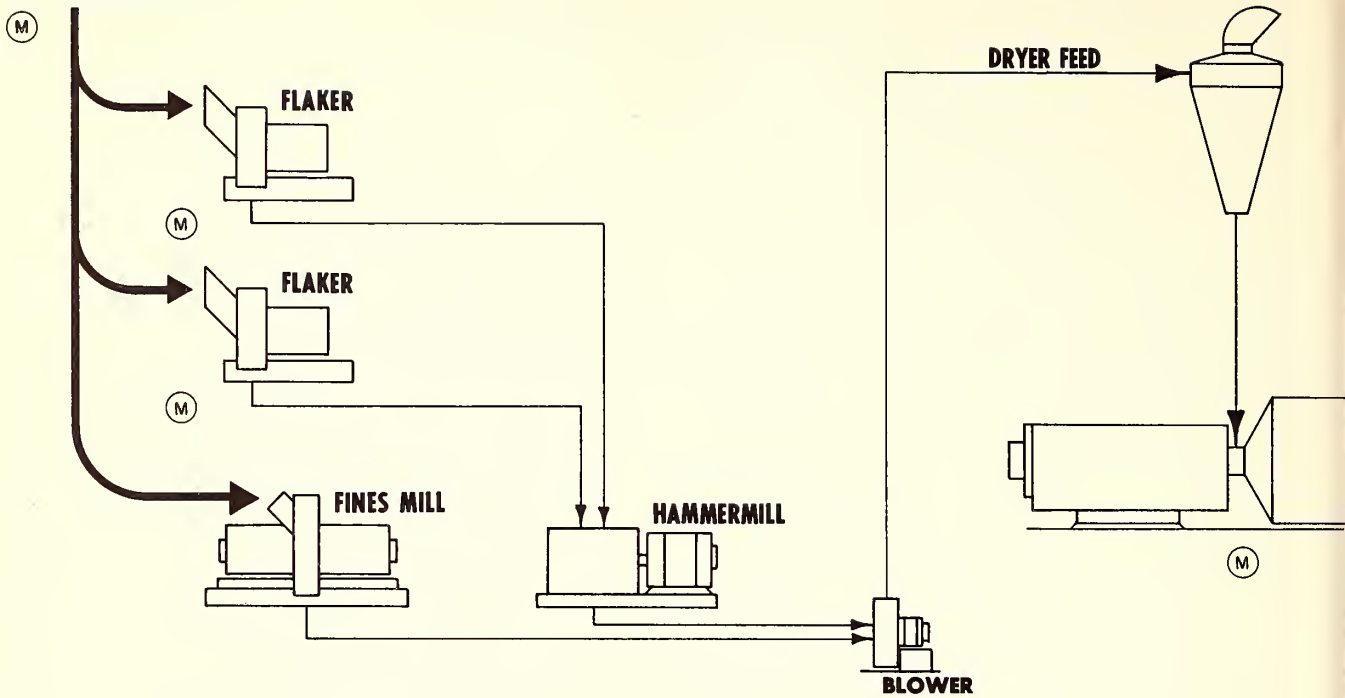
1. Procurement of wood raw material (daily requirement of 93 cords of bark-free cordwood, supplemented by 6.1 tons of green solid wood sawmill residue).
2. Reduction of wood raw material to desired flake configuration.
3. Drying of flakes to a low moisture content value (ordinarily about 6 percent).
4. Addition of resin binder and wax emulsion size to dried flakes (much of the economics of board manufacture are contingent upon the most effective use of the minimum quantity of these ingredients).
5. Forming of mats to exact size, thickness, and weight.
6. Pressing of mats into boards with exact control of time, temperature, and pressure.

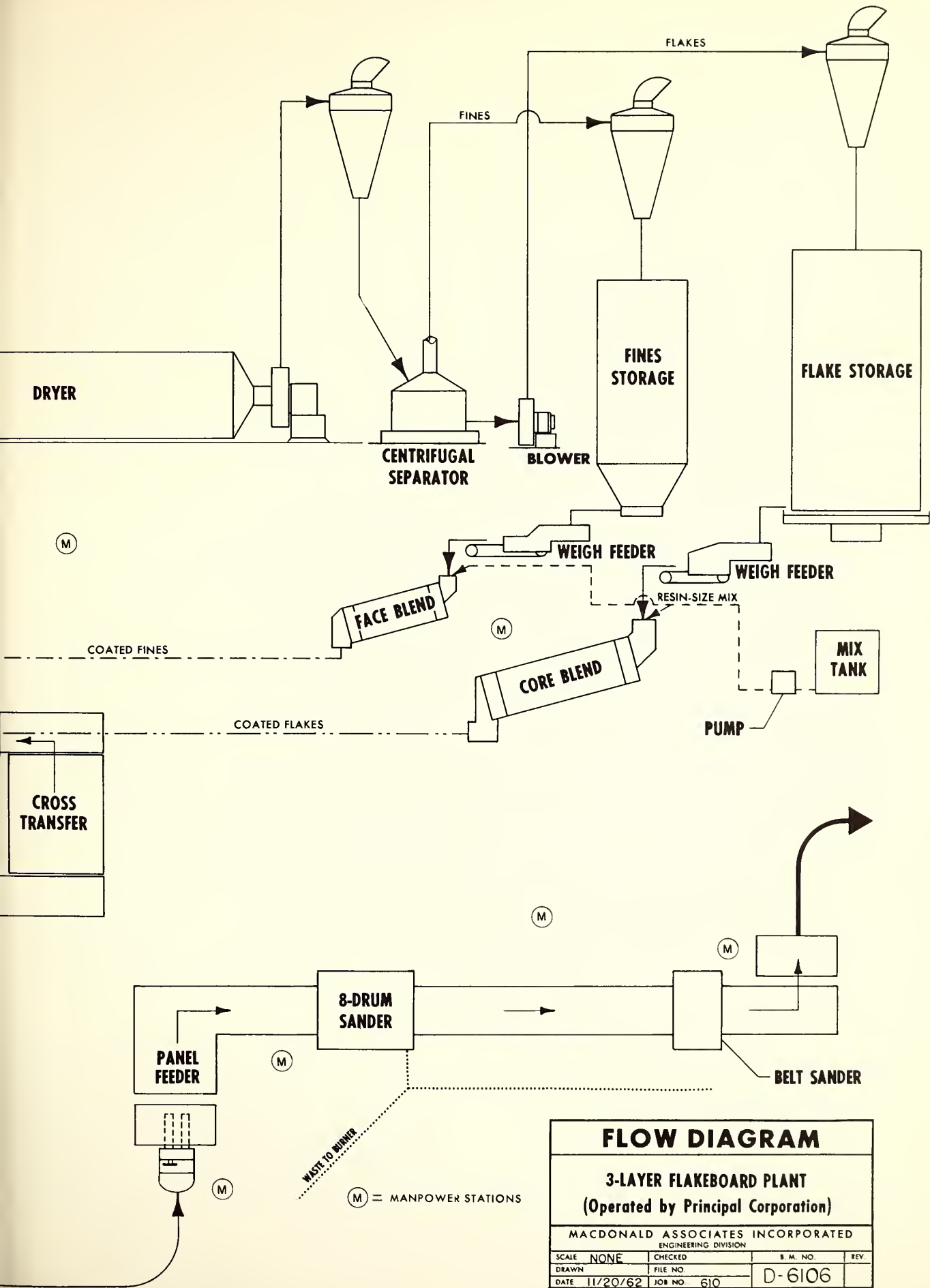
7. Trimming of "hot" boards to finished size.
8. Cooling and curing of trimmed boards.
9. Sanding of cured board to exact thickness (industry standard now $\pm$ 5 mills tolerance).

The flakeboard manufacturing plant will require 11 operators, a laboratory technician, a shift foreman, and a finishing foreman per eight hour shift; they will be under the general supervision of a plant superintendent. Manpower stations and job descriptions are as follows:

1. *Yard Carrier Operator*: Transfers wood raw material to wood preparation department from intermediate storage location adjacent to the flakeboard plant; cooperates with the collection yard in maintaining proper inventory of wood raw material.
2. *Wood Preparation Operators (2)*: Convert solid green wood into properly prepared flakes; maintains in-process material at necessary level to supply production demand.
3. *Dryer/Boiler Operator*: Oversees operation of the dryer and classifier equipment; adjusts and oversees operation of automatic steam plant.
4. *Mixing Operator*: Prepares properly dried flakes by adding wax emulsion sizing material and resin binder; coordinates delivery of prepared flakes with demands of the forming station.
5. *Forming Operator*: Oversees operation of automatic mat forming and sizing equipment; adjusts performance to conform with physical requirements imposed by finished products; uses automatic weight-station to monitor function of the forming equipment; and oversees operation of the pre-press.
6. *Press Operator*: Operates press charger, press, and press receiver; adjusts variables of time, temperature, and pressure to correspond with product requirements.
7. *Trimsaw Operator*: Oversees operation of automatic panel saw that performs edge and end trimming of hot boards delivered from the press; uses fork lift to deliver packages of trimmed panels to "hot" storage and feeds cured panels to the sander panel feed machine.
8. *Sander Operator*: Oversees operation of the automatic panel feeder, adjusts the sander, and replaces sandpaper.
9. *Panel Grader*: Assists the sander opera-

CORDWOOD DELIVERY





tor, inspects surfaces and edges of each sanded panel, and marks each panel with a grade identification stamp.

10. *Packager/Fork Lift Driver*: Receives panels from the panel grading station; places corrugated paper covers on top and bottom of modular bundles of panels; steel straps packages; and transfers packages to inventory or shipping point with a fork lift carrier.
11. *Shipping And Finishing Foreman*: Responsible for sanding, grading, packaging, transfer of panels to inventory or point of shipping, and inventory control of finished panels.
12. *Laboratory Technician*: Responsible for establishing and conducting a routine quality control program; advises shift foreman of process changes necessary to maintain quality of production in compliance with product specifications.
13. *Supervisor-Maintenance Man*: Responsible for manufacture of board products, schedules raw material deliveries, controls processing performance, fills orders for product and performs preventative maintenance.
14. *General Superintendent*: Responsible for overall operation of the manufacturing unit, instructs supervisory personnel, and coordinates shipping requirements with product manufacture and raw material procurement.

Three additional men will be required during the second and third shifts (5 days per week) to operate the debarking equipment in the log collection yard. These men should be under the control of the general superintendent of the flakeboard plant, and the direct labor and payroll overhead costs involved in their performance should be charged to the flakeboard plant.

Installed Cost of Flakeboard Manufacturing Plant

The estimated cost of the described flakeboard plant, including buildings, installation, and engineering design fees is \$1,425,000.

Satellite Manufacturing Activities

Satellite processing units are, to a large extent, captive consumers of the products

manufactured by the principal corporation (complex). In spite of this, the relationship between the complex and the satellite producer must be one of mutual confidence and respect. In its role as a supplier, the complex must consistently furnish the satellite producer with raw materials of a quality at least equal to that furnished its own remanufacturing activities—and at competitive prices. The satellite, conversely, is obligated to produce according to mutually determined specifications; some initial technical assistance from the complex will undoubtedly be required. By following these procedures, the complex gains the loyalty of the satellite producer and is assured the optimum fair return on products sold through its marketing organization. Devious practices by the complex—such as providing sub-standard materials to the satellite—will result in lower profits for all participants and will destroy the operational harmony necessary to the success of the undertaking.

Pallet Manufacture

The availability of dry, sorted, and properly sawn lumber from the complex will provide the satellite pallet manufacturing unit with a two-fold competitive advantage; first, it will permit the manufacture of better grade pallets as opposed to those manufactured from green lumber; and, second, it will provide a manufacturing cost advantage as opposed to the cost encountered in using unsorted, roughly sawn lumber. There are many ways to manufacture pallets, ranging from crude hand nailing operations carried on in open sheds next to portable sawmills to the highly sophisticated automated production lines. The makeshift type of operation produces poor products and sells to the bottom of the market. The highly refined activities require large capital investment, must manufacture large volumes of pallets and ordinarily operate at very low profit margins. The ideal arrangement seems to be a happy medium between these two extremes.

The recommended pallet manufacturing arrangement does not use automatic nailing machines—which are regarded in some quarters as being essential to the economic manufacture of pallets. Rather, the plant, diagrammed on page 176, involves the use of manpower as a basic tool, assisted by mechanical handling devices.

Drawing on a yard inventory of 200,000

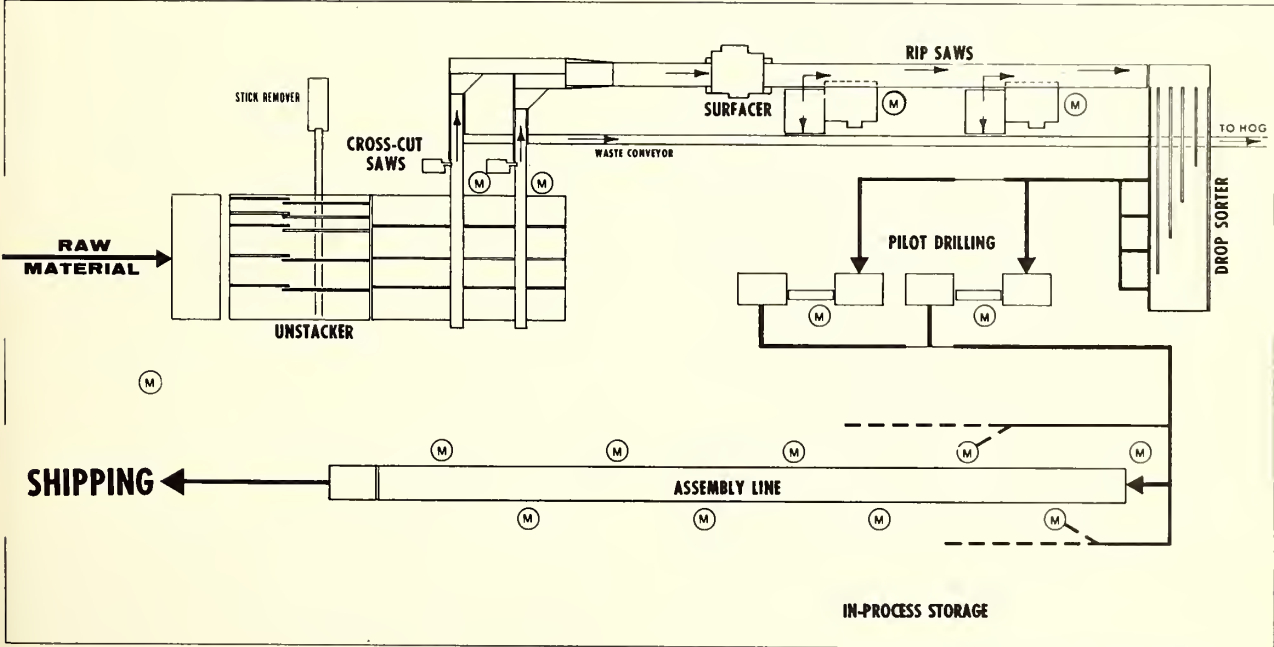
board feet of dry lumber, the first stage of manufacture will be sizing of lumber to meet length and width requirements established by orders for pallets. Stickered piles of lumber, selected from the inventory for their suitability to a particular processing run, will be broken down by an automatic unstacking machine similar to the unit used by the rough lumber remanufacturing operation. The unstacking machine will feed two cross-cut saw stations which, in turn, feed a double surface planer—for full or skip surfacing, as may be desired. Two rip sawing stations will be provided to cut individual pieces to width. Properly sized material resulting from these operations will be automatically drop-sorted into box pallets, preparatory to transfer to the pallet assembly operation. It is assumed that preparation of material into usable pieces of proper width and length will result in a net loss of approximately 15 percent of the infeed lumber.

Pallets will be constructed from prepared stock on a manned assembly line. At an average of 10.2 board feet of lumber per pallet, and allowing for the yield factor in converting rough lumber into prepared stock,

the assembly line will manufacture 1,666 pallets per eight hour shift. This rate of productivity, based on 7.5 productive hours per shift, will require an assembly line speed of 37 feet per minute and an output of one pallet per minute. The arrangement of work stations along the line will vary with the individual design of each pallet; runs of pallets should be scheduled to permit as long a period of time as possible between model changes. Loads of prepared material will be carried to the proper work stations by fork lift carrier, and each pallet will be constructed as it progresses on the assembly line past individual work stations.

When the finished pallets reach the discharge end of the assembly line they will be stacked in modular bundles and steel strapped for shipping. A manufacturers identifying brand name could be burned into each pallet as it arrives at the end of the assembly line.

Pilot holes for nailing can be drilled as an intermediate step in preparation, prior to delivery of the sized material to the assembly line stations. Drilling can be performed with simple machinery using jigs and high speed drill bits.



(M) = MANPOWER STATIONS

FLOW DIAGRAM			
PALLET MANUFACTURING PLANT (Satellite Operation)			
MACDONALD ASSOCIATES INCORPORATED ENGINEERING DIVISION			
SCALE 1/16" = 1'-0"	CHECKED	S. H. NO.	REV.
DRAWN	FILE NO.	D-6104	
DATE 11/7/62	FOR NO. 610		

Manpower Requirements

In addition to an administrative and clerical staff, the satellite pallet manufacturing plant will require 17 operators and one foreman per shift, as follows:

1. *Fork Lift Operator*: Supplies unstacker with packages of dry lumber selected from inventory to meet production specifications; transfers material from drop sorter to next step in processing; assists in truck and rail car loading.
2. *Cross-Cut Operators (2)*: Cross cut rough dry lumber to lengths required to meet production orders; eliminate defective areas; reject defective material cut from lumber.
3. *Rip Saw Operators (2)*: Ripsaw stock delivered from cross cut stations to proper width to meet production orders; reject scrap developed by the operation.
4. *Drill Operators (2)*: Prepare drill jigs and drill sized stock with pilot holes for nailing.
5. *Assembly Line Operators (8)*: Position component parts and nail in place to construct pallets. The specific activities of these men may differ with each type of pallet that is manufactured.
6. *Line Tenders (2)*: Drive fork lift carrier to service drilling operation and assembly line with pallet loads of component parts; bundle and steel strap pallets as they accumulate at the discharge end of the assembly line; and move bundles of pallets to shipping point or storage preceding shipment.
7. *Foreman-Maintenance Man*: Responsible for general operation of the pallet manufacturing plant; performs preventive maintenance.

Installed Cost of Pallet Plant

The estimated installed cost of equipment to prepare raw material and manufacture 20,000 board feet of lumber into the equivalent of 17,000 board feet of finished pallets per eight hour operating shift is \$121,000. The required working area, estimated to be 24,000 square feet, will be leased from the complex.

Unassembled Furniture

The designation of this satellite unit as an unassembled furniture manufacturing plant

is not intended to impose a restriction upon its processing and product ability. This unit has an excellent opportunity for product diversification and for eventual expansion of capacity to additional product lines. Because the inclusion of extensive facilities in the start-up configuration of the plant would be impractical, planning has been limited to the provision of equipment that will serve the manufacturing needs of products that are known to be readily marketable. As the reputation of the satellite and its financial resources grow, it will eventually arrive at a proper position to increase its scope of activity.

The products that should be manufactured, which provide the basis for subsequent recommendations, include casual furniture items—e.g.: student furniture, patio furniture, novelty furniture, and juvenile furniture. It appears at present that these products will find a good market in partially assembled, unassembled, or kit form, either in finished or unfinished condition.

The services of a well-qualified consulting designer will be required to design the line of products that will be manufactured. Much of the sales success of this manufacturing activity will be contingent upon the ability of such an individual to conceive products that will capture buyer interest.

It is assumed that the unit will not purchase unprocessed kiln dried lumber from the complex; instead, it will use dimension products and some rough remanufactured products obtained from the remanufacturing operations. Flakeboard will be used in conjunction with the use of solid wood. The daily consumption of these raw materials is expected to be in the neighborhood of 3750 square feet of flakeboard and the equivalent of 5000 board feet of lumber in the form of solid wood components. An assumed "average" product will contain 10 board feet of solid wood and eight square feet of veneer-overlaid flakeboard or solid wood core stock. Daily output in numbers of finished items, then, will total 500 pieces.

Production facilities will include conventional wood working machinery, pressing equipment to laminate veneers (purchased as assembled veneer faces and backs) onto flakeboard cores, and limited means for lacquer coating. Since a specific product cannot be logically recommended at this time, it follows that to provide a process flow and equipment layout plan would be nothing more than academic. This does not, however, preclude the capacity to recommend specific items of basic machinery that should be available for processing.

Equipment Requirements

The following are considered to be the basic minimum requirements needed to equip the operation:

Fork Lift Carrier (1 required)
Planer—Single Surface
Straight Line Rip Saw
Router
Shaper
Table Saws (3 required)
Multiple Head Boring Machine
Pedestal Borer
Band Saw
Panel Edger
Double Surface Glue Spreader
Shuttle Feed Panel Press
Panel Sizing Saw
Single Surface Sander
Contour Sander (2 required)
Spindle Sander (2 required)
Scissors Lifts (3 required)
Conveyors—Miscellaneous
Refuse Collection System
Coating and Drying Installation

Manpower Requirements

In addition to an administrative and clerical staff, the unassembled furniture manufacturing unit will require 17 operating personnel and one supervisor per eight hour shift, identified as follows:

1. *Fork Lift Driver:* Operates fork lift carrier to supply raw materials to the various work stations; transfers in-process material between stages of manufacture; and transfers packaged products to the shipping point.
2. *Panel Preparation Crew (4):* Edge band flakeboard with solid wood as may be required; apply veneer overlay, faces and backs to flakeboard or solid wood core; and size and sand veneer overlaid panels.
3. *Machine Operators (8):* Operate various machines to convert dimension products purchased from the complex into finished items; machine panel products prepared internally; and prepare materials for finishing or shipping.
4. *Finishers (2):* Apply finish coating to prepared component parts.
5. *Packagers (2):* Assemble component parts and package as units in attractively printed cartons; maintain inventory records; and route packaged products to proper destinations.
6. *Supervisor-Maintenance Man:* Respon-

sible for all manufacturing activity; orders raw material; regulates in-process inventory; translates product requirements into production specifications and work schedules; performs preventive maintenance.

Installed Cost of Unassembled Furniture Manufacturing Plant

The estimated cost of the required processing equipment, including only limited facilities for product finishing is \$160,000. The required working area, estimated to be 20,000 square feet, will be leased from the complex.

Upholstered Furniture Frames

The manufacture of upholstered furniture frames offers a profitable small scale business ideally suited to the theme of satellite operation within the structure of the processing complex. Frames are an intermediate product that more and more manufacturers of upholstered furniture prefer to purchase in knocked-down form, ready to be assembled at the point of use with limited application of manpower and a minimum expense in the form of work area occupied. The success of a frame manufacturer in acquiring business is contingent upon his ability to effect efficient conversion of raw material into a finished product meeting rigid customer specifications. Quality workmanship is required, but the product is relatively crude by the standards applied in other sectors of the furniture industry. Typically, dimension tolerances are liberal and surfaces of component pieces developed during machining operations are normally accepted without additional finishing.

Product design is almost always the responsibility of the customer. The sizes and shapes of component pieces and the construction of the finished unit are usually established by detailed instructions accompanying each order. It is the responsibility of the fabricator to manufacture the frame in compliance with these specifications. Some latitude of action is extended for improvement by the producer, if both parties can be benefited.

Profitable manufacture in this competitive product field is best achieved by the availability of the proper processing machinery and an alert management able to improve operating efficiency.

This satellite unit will be able to extract considerable benefit from its relationship with the complex. It will purchase its raw material mainly in the form of lightly processed dimension from the remanufacturing operation. This procedure will give a cost advantage compared to open-market purchase of dimension. Further, it will relieve the satellite of the necessity to handle rough dry lumber. The majority of frame suppliers start with rough lumber and, accordingly, must apply a considerable amount of overhead cost against preliminary processing. By contrast, the overhead that will apply to all units affiliated with the complex is at a minimum.

The satellite will keep a very limited inventory, not exceeding 25,000 board feet of prepared dimension material. This inventory will be required only to assure the capability to maintain continuous operation in the event supplies from the dimension plant are temporarily curtailed. Daily consumption of dimension stock will total the equivalent of 5000 board feet of lumber. Assuming an average consumption of 11 board feet per unit, this amount of raw material will enable the manufacture of 450 frame assemblies per eight hour operating day.

As explained in the discussion of the manufacture of unassembled furniture, no real object can be served by providing a floor plan and process flow diagram. The manufacturing operation will comprise a logical arrangement of conventional wood working machinery positioned to allow efficient in-feed of material preparatory to machining and to facilitate smooth flow to the next operation after the completion of each task.

Equipment Requirements

The following are considered to be the basic minimum requirements needed to equip the operation:

Fork Lift Carrier
Surfacer—Single Surface
Straight Line Rip Saw
Mortiser
Band Saw
Table Saw (2 required)
Cut-Off Saw (2 required)
Multiple Boring Machine (3 required)
High Speed Drill
Scissors Lift (2 required)
Refuse Collection System
Roller Conveyors—Miscellaneous

Manpower Requirements

In addition to an administrative and clerical staff, the upholstered furniture frame manufacturing unit will require 13 operating personnel and one foreman per eight hour operating shift, identified as follows:

1. *Fork Lift Operator*: Drives fork lift carrier to supply raw material to the various work stations; transfers in-process material between stages of manufacture; transfers bundled frames to the shipping point; and assists in loading shipments.
2. *Machine Operators (7)*: Operate various machines to convert dimension products purchased from the complex into frame components.
3. *Assemblers (2)*: Assemble component parts into sub-assemblies, group sub-assemblies required for each frame, and accumulate assemblies in steel strapped bundles preparatory to shipping to customer.
4. *Foreman-Maintenance Man*: Responsible for all manufacturing activity, orders raw material, regulates in-process inventory, translates orders into production specifications and work schedules, and performs preventative maintenance.

Installed Cost of Upholstered Furniture Frame Plant

The estimated cost of the required processing equipment is \$89,900. The required working area, estimated to be 16,000 square feet, will be leased from the complex.

Bark Mulch and Animal Litter

Bark mulch and animal litter find entirely different uses and their physical characteristics are dissimilar. Nevertheless, similarities involved in their processing make it desirable and prudent to consolidate facilities for their manufacturing under a single management. Both products are derived from the conversion of processing residues that will be generated by various other activities of the complex. The debarking operation at the collection yard will develop 11.7 tons of bark per day, and the various wood machining operations will develop 12 tons of shavings per day.

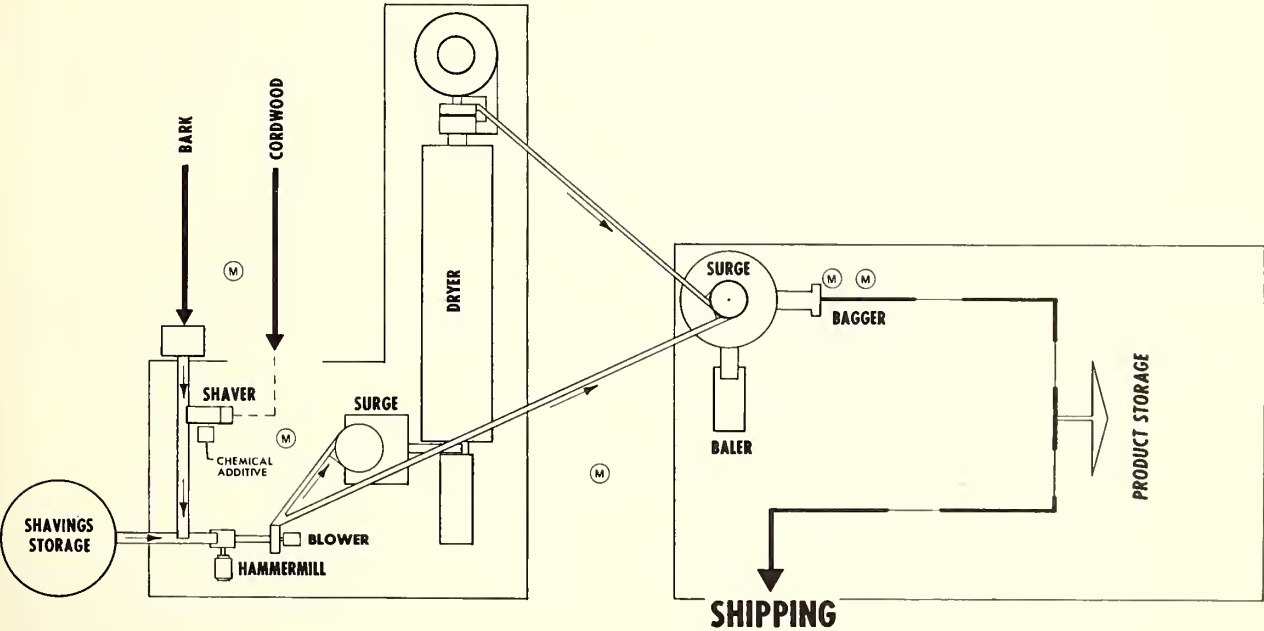
Bark Mulch is manufactured by hammer-milling bark into coarse particles. All species of hardwoods, with the exception of walnut, are equally acceptable in the end product. Hammermilling should be performed with the bark at 40-60 percent moisture content, thus avoiding the output of an excessive amount of undesirable fine material. A limited quantity of a chemical source of nitrogen should be added to the bark prior to milling. The milling action serves to thoroughly distribute the chemical throughout the resulting particles. Ammonium sulfate and ammonium nitrate are commercially available chemical sources of nitrogen; one or the other of these compounds can be added in the respective proportions of 115 pounds or 72 pounds per ton of dry bark. The application of the chemical can be either in solid or liquid form; liquid spray application is preferred if the bark tends to be dry. The addition of nitrogen minimizes disruption of the nitrogen balance of the soil caused by bacterial decay of bark particles.

The output of bark particles from the hammermill will be fed to a surge hopper and thence, by volumetric metering, to a flash

type high temperature dryer. The dryer will reduce the moisture content of the particles to an average of 15 percent; this step serves mostly as a means of reducing shipping weight. Drying is not mandatory, but it does add to the quality of the product and seems well worth the slight additional expense involved in its performance. The dried bark-chemical mixture—now mulch—will be collected in a storage bin preparatory to bagging in large attractively printed moisture resistant bags, each holding 4.25 cubic feet of product. Optimum processing capacity has been established at 1360 cubic feet per eight hour day, the equivalent of eight tons of prepared product.

Animal Litter will be manufactured in two different forms: (1) as shavings, and (2) as prepared particles.

Dry shavings are the most commonly used form of litter. They ordinarily are shipped to the user dried to about 12 percent moisture content value and compressed into bales weighing from 50 to 60 pounds each. The volume users in the poultry and hog raising business prefer softwood or low density hardwood shavings, but they are not unwilling to



(M) = MANPOWER STATIONS

FLOW DIAGRAM				
BARK MULCH & ANIMAL LITTER (Satellite Operation)				
MACDONALD ASSOCIATES INCORPORATED ENGINEERING DIVISION				
SCALE 3/64"=1'	CHECKED	S. M. HO	REV	
DRAWN	FILE NO.			
DATE 11/7/64	JOB NO. 610		D-6105	

accept the denser hardwood species. Small animal breeders, also volume consumers of shavings, have a strong preference for non-resinous softwoods and low density hardwoods. In most instances they will not accept dark colored or high density woods. These diverse requirements can be met through proper provision by the manufacturer, but they impose a need to maintain a warehouse inventory to permit product accumulation by species characteristics.

Particles used as litter have limited but growing demand. The principal outlet is the small animal breeding industry, which demands commercially sterilized material. This sterilizing step is to kill bugs, render harmless the germs in rodent feces, etc. before shipment. Fortunately, the type of flash dryer best suited to processing requirements also qualifies as an acceptable sterilizing device.

Shavings will derive from two sources: (1) the processing activities of units of the complex that produce shavings as a by-product of machining operations, and (2) through direct conversion of green round wood by means of a shavings manufacturing machine. Shavings from the first source will be transferred to a surge storage receiver by a low pressure pneumatic conveyor system linked with the remanufacturing, unassembled furniture and furniture frame plants. It is expected that these processing facilities will be a source for approximately 12 tons of dry shavings per day. The production of shavings from the second source will involve the daily conversion of 20 cords of low grade poplar, magnolia, soft maple, and basswood in cordwood form.

The material flow and processing steps are shown by the flow diagram on the opposite page. Briefly described, most green shavings manufactured from cordwood will be dried, baled, and stored pending shipment. A certain percentage will be routed through a hammermill before the drying step, to reduce them to particle size. Following drying, the resulting particles will be bagged with the same equipment and procedures as those applied to the manufacture of bark mulch. Dry shavings derived as a manufacturing by-product will by-pass the dryer and go directly to the baling machine.

The plant will operate for two eight hour shifts per day, processing 20 tons of material, dry weight basis, per shift. The day shift, corresponding to the operating period of most other units of the complex, will split its output between baling shavings and manufacturing bark mulch. The second shift will

manufacture baled shavings and bagged particles from green cordwood.

Manpower Requirements

In addition to an administrative and clerical staff, the mulch and litter manufacturing plant will require four operating personnel and one foreman per eight hour operating shift, identified as follows:

1. *Payloader operator*: First shift: recovers bark from bulk storage pile and delivers to the processing starting point.
Second shift: picks up cordwood in the storage yard and delivers it to the processing starting point.
2. *Milling-Dryer Operator*: Operates hammermill as required for conversion of bark or green shavings into particles; adds chemical to bark mulch; operates dryer for drying bark, green shavings or green particles.
3. *Balers/Baggers (2)*: Operate bagging machine or baling machine, depending upon material being processed; use fork lift carrier to transfer baled and/or bagged material to warehouse storage; assist in shipping.
4. *Foreman-Maintenance Man*: Responsible for manufacture of various end products; regulates product inventory; directs shipping; performs preventative maintenance.

Installed Cost of Mulch-Animal Litter Plant

The estimated cost of the required processing equipment is \$123,000. The required working area, estimated to be 10,600 square feet, will be leased from the complex.

Preservative Treating Plant

The proposed preservative treating plant will be a small processing unit intended to service a relatively restricted market for treated fence posts, treated poles for signs and similar uses, and treated lumber. Market investigation has disclosed a good market potential within Kentucky, provided suitable treated products are made available and merchandised with up-to-the-minute selling techniques. The Bluegrass region offers a particularly attractive possibility for the sale of upgraded fence posts and rails (usually red

oak cut 1" x 6" x 6") for rail fences. Since product requirements reflect directly upon the establishment of processing facilities, it is pertinent to summarize at this point the type and character of products that should be manufactured to satisfy the detected market potential for fencing materials.

Insofar as the buying public is concerned, the differences between technicalities of various treating methods and the chemicals used are purely academic. A treated fence post sold by a reputable manufacturer is a treated fence post. If a post is treated, it assumedly has durability, leaving the buyer to be attracted by the appearance and utility of the product. A neat appearance derived from rounding, a pointed end to simplify the job of installation, a product that is clean to handle, a flat face on posts intended for rail fences, and even the availability of pre-painted posts and rails—these are the characteristics that should attract customers. They are the characteristics of proprietary products, not those of a roughly modified product of the growing forest. Upgraded products of the nature described obviously will appeal only to a limited segment of the total market for fencing; they will not compete against the rough products available from farm wood lots. They are, however, the type of products that are recommended for manufacture by the satellite treating plant.

The capacity of the recommended plant will be 7.5 thousand board feet per eight hour operating day, assuming that two retort loads will be processed during this period of time. The retort will be 4 feet in diameter by 34 feet in length, this being about the minimum practical commercial size. Preferred treatment will be with a trade brand of fluorochrome arsenate phenol, a water borne wood preservative, with a minimum standard of .50 pounds of retained solids per cubic foot of treated product. The equipment will be a pressure system and will be able to apply pentachlorophenol if the occasion arises for the application of this preservative.

It is planned that the unit will treat five cords of roundwood and 5000 board feet of lumber and cord squares per shift. The average round post will be five inches in diameter at the small end and seven feet in length; there will be approximately 60 pieces per cord. Cord squares, excellent for conversion into treated sign posts, will average five inches across a single face and will be available in lengths up to 16 ft. An inventory of cordwood will be maintained for the plant by the log storage yard, and an inventory of sawn material intended for treat-

ing will be maintained by the air drying yard. These off-premises inventories will free the treating plant from the need to maintain its own inventory of raw material preparatory to processing. The treating plant will, however, keep a one or two day working supply on hand, distributed in proportion to the relative quantities of cordwood and sawn material to be processed. It is expected that an inventory of treated products averaging 30 days production (225,000 board feet) will be maintained by the plant in its own product storage yard.

The manufacturing facilities will include means for turning, pointing, and facing posts. Properly prepared material will be batch loaded into the retort and subjected to temperatures and pressures appropriate to the type of treatment and the nature of the preservative being applied. Facilities for surface coating of treated products with paint or pigmented acrylic materials will not be included in the original plant installation; they may be added at an appropriate time in the future. The transfer of products from one processing stage to another will be accomplished by fork lift carrier. Deliveries of raw materials to the plant will be made by equipment and personnel attached to the sources of such materials.

Equipment Requirements

The following are the basic minimum equipment requirements needed for the operation:

Fork Lift Carrier
Pole Lathe
Post Pointer
Post Facer
Cross Cut Saw
Pressure Treating Plant
Steam Generator
Waste Hog
Waste Disposal System

Manpower Requirements

In addition to an administrative and clerical staff, the preservative treating unit will require four operating personnel and one working foreman, identified as follows:

1. *Fork Lift Operator*: Drives fork carrier to procure material from the standby storage yard and feeds it into processing; transfers in-process material between operator stations; assists in loading and unloading charges for the treating retort; places treated material in storage area; and assists in loading for shipment.

2. *Machine Operators (2)*: Operate lathe, pointer, facer, and cross cut saw as required to prepare material for processing.
3. *Treating Plant Operator*: Responsible for proper charging, operation, and discharging of the pressure treating plant.
4. *Foreman-Maintenance Man*: Responsible for overall operation; maintains delivery schedules of material to be processed; maintains yard inventory control;

oversees shipment of products; performs preventative maintenance.

Installed Cost of Preservative Treating Plant

The estimated cost of the required processing equipment is \$65,000. The required building space, estimated to be 5000 square feet, will be leased from the complex.

Section IV

Operational and Economic Performance

Scale of Enterprise

The processing facilities recommended in the preceding section will provide direct employment for 157 production employees, 25 supervisors, 8 clerical workers, and 3 individuals at top management level. In addition, each of the five satellite units will have its own management and clerical personnel. The subsidiary marketing corporation will employ a total of nine, including the sales manager.

The number of jobs that will be indirectly created in servicing the needs of the complex cannot be precisely established; however, a conservative estimate calls for at least 60 men to be engaged in procurement and delivery of rough forest products. Using figures applying to the average production per man in Kentucky, 1958, an additional 100 to 120 men will be employed in logging, hauling, and sawmilling to provide the complex 35,000 board feet of rough green lumber. Other jobs will be created in the geographic area about the complex to meet requirements for supplies, machine parts, transportation services, and maintenance services.

The annual payroll for all activities of the complex, including the two subsidiary corporations and the satellite units, will approach \$1.21 million. This amount is premised on the payment of wages and salaries somewhat above the prevailing regional level, in agreement with the absolute recommendation that the complex should not be established within eastern Kentucky with any intent of exploiting the present level of wages. It is likely that wages throughout the region will increase, and it is felt that a valid economic projection must recognize this fact.

The annual cash flow for goods and services will exceed \$7.5 million for the combined operations. The purchase of saw logs, cordwood, and rough green lumber from independent sources—i.e., other than from the subsidiary land management corporation—will involve an additional expenditure of approximately 1.2 million dollars, which will be dispersed throughout the 50 mile procurement radius.

The processing facilities that have been described for the principal corporation will

require an investment of \$3.87 million, including working capital. Of this amount, \$801,300 will be for buildings and \$135,000 for an “improved” site. Total investment in satellite processing facilities is estimated at \$750,700 for installed equipment and working capital; the satellite producers will rent building space from the principal corporation. The subsidiary land management corporation will require an estimated \$551,000, mostly for purchases of forest land; and the marketing corporation will, at an optimum level of operation of the complex, require \$249,000—mostly to cover accounts receivable.

Table IV-I on pages 82-83 provides a tabular summary of important economic and operating characteristics of the complex. Data from which the summary has been compiled are provided in this section together with descriptions of the organization and conduct of business of each major element of the complex. It is to be noted that the return on invested capital shown by the summary is over and above the allowance for 6 percent interest included as an indirect cost in the projected operating statement of each activity.

Start-up Configuration

Now that the order of magnitude of investment that will be involved in establishing the complex has been determined, a review of the approach that should be taken to permit it to reach its optimum production capacity is pertinent. Of necessity, the detailed economic projections that follow in this section are based upon full scale activity; i.e., processing 70,000 board feet of lumber and 137 cords of cordwood per day.

Ideally, the operations of the complex should be initiated with installed facilities extending through the remanufacturing plant and milled products plants, but with production geared to a gradual build-up to a capacity of 35,000 board feet per day. Among the satellite activities, the most important from the standpoint of facilitating utilization of low grade material is the pallet plant. The early installation of this unit should be encouraged from the onset by the management of the complex.

TABLE IV-1

CONSOLIDATED

	SHIFTS PER DAY	EMPLOYEES (super- visory)	(oper- ating)	DAYS PER YEAR	YEARLY PAYROL -----
<u>PRINCIPAL CORPORATION</u>					
Administrative Office		2	2		43.1
General Office		2	5		61.5
Collection Yard	1	1	6	250	32.5
Lumber Manufacture	1	1	10	250	58.1
Air Yard & Dry Kiln	1	1	7	350	55.7
Rough Lumber Processing	2	3	24	250	139.4
Core Stock Manufacture	1	1	4	250	23.0
Dimension Manufacture	1	1	9	250	51.3
Solid Wood Paneling	1	1	4	250	29.8
Flakeboard Manufacture	3	8	33	300	270.9
Improved Site Buildings & Facilities					
TOTAL		21	104		737.4
<u>LAND MANAGEMENT CORPORATION</u>					
		1	3		28.2
<u>MARKETING CORPORATION</u>					
		1	8		98.9
<u>SATELLITE UNITS</u>					
Pallet Manufacture	1	1	16		88.9
Unassembled Furniture	1	1	17		94.0
Upholstered Furniture Frames	1	1	13		73.5
Mulch & Animal Litter	2	2	8		57.3
Preservative Treatment	1	1	4		29.9
TOTAL		6	58		343.6
<u>INDEPENDENT SUPPLIERS</u>					
Sawmills					
Saw Log Suppliers					
Cordwood Suppliers					
Loggers and Haulers (contract)					

PERFORMANCE DATA

INSTALL- TION COST	WORKING CAPITAL	TOTAL INVESTMENT	NET SALES	NET PROFIT	NET AFTER TAXES	RATE OF RETURN % <u>1/</u>
-----	thousands	of dollars	-----	-----	-----	

5.0	4.6	9.6				
10.0	8.8	18.8				
155.0	136.0	291.0	863.1	14.8		
311.1	1.5	312.6	572.5	55.9		
450.0	79.8	529.8	369.0	104.8		
147.5	10.5	158.0	906.9			
71.5	15.6	87.1	436.9	71.6		
170.5	30.4	200.9	808.3	58.9		
90.0	11.0	101.0	290.1	106.9		
1,150.0	74.0	1,224.0	2,041.8	420.3		
		135.0				
		801.3				
		3,868.8	7,288.6	833.2	351.3	13.8
525.0	26.0	551.0	292.7	27.6	19.3	
20.0	229.0	249.0	1,042.3	607.7	274.3	
121.0	54.6	175.6	700.2	87.4	46.0	26.2
160.0	64.3	224.3	808.7	111.5	57.7	25.3
89.0	17.0	106.0	458.5	49.4	29.1	27.5
122.5	27.5	150.0	269.7	28.3	19.6	13.1
65.0	29.8	94.8	252.6	21.5	15.3	16.1
		750.7	2,433.6			

1/ in excess of 6% interest charged on investment and working capital.

568.7
168.0
291.6
174.0

In the event that the availability of investment capital is restricted, the installation of the flakeboard manufacturing plant could be delayed. This is not desirable, however, because the present market situation for the sale of flakeboard is excellent, and entry into the field will not be faced with strong competition. The situation could well change to the extent that other plants might be placed in production and impose a serious competitive challenge to starting operations in eastern Kentucky at some later date. A delay, therefore, could result in a disadvantage to the complex.

As an alternative to the above approach, it would be feasible to initiate the complex based on the immediate installation of flakeboard manufacturing facilities, to be followed at a later date by the expansion to lumber manufacture, etc. This approach would permit an orderly program of land procurement during the time that the flakeboard plant was the sole operating facility of the principal corporation.

The installation of partial facilities, or facilities modified to any appreciable extent from the recommendations provided in this report is to be avoided. None of the recommended activities of the principal corporation, with the exception of the manufacture of flakeboard, is capable of profitable operation without the full support of the other facilities. Likewise, not one of the satellite units should be established unless it is associated with the processing complex. The reasons for these recommendations are economic and are self evident in the data provided in subsequent pages of this section. The complex as a whole is able to provide a processing cost advantage, within the framework of outside economic forces, that must be present if any one of the recommended processing activities is to succeed.

The Land Management Corporation

This subsidiary corporation will perform both as a primary source of wood raw material supply and as a purchasing agent serving to procure rough forest products to meet the processing needs of the complex. Along with these activities, it will have the long range assignment of working toward improvement of the average quality of wood raw material available within the established procurement area about the complex.

As a primary source of supply, this corporation will depend wholly upon independent contractors to conduct logging and hauling, working in timber that it owns or otherwise controls. It should function only as a service activity and should not become involved in the ownership of equipment. It should conduct its activities as a profit making business and should invoice the manufacturing corporation of the complex, through the log collection yard, on the same basis as other saw log and cordwood suppliers.

Forest Land Ownership and Control

The need to own forest land has been discussed previously and should be considered essential in terms of the effect it will have on the security of supplies of rough forest products needed by the complex. The extent of ownership or control of forest land is established at a minimum of 26,000 acres, well stocked with mature timber. This acreage should provide a sufficient quantity of sawtimber to give a sustained yield of 50 percent of the annual saw log requirements of the complex. This determination has been based on an expected average annual growth of 150 board feet per acre.

The economic projection for the land management corporation, as provided below, has been predicated on the outright purchase of 26,000 acres of forest land at \$20 per acre, a total investment of \$520,000; this aggregates a rather heavy investment. Alternatives to purchase include first option agreements, long-term leases, and forest management agreements.

A first option agreement held by the land management corporation, in return for forest improvement/management services, would give the corporation the right to request sale by sealed bid for portions of the timber stand included under the terms of agreement. Such sales would be heavily weighted to the advantage of the corporation, largely because of its complete familiarity with the timber gained through the discharge of its management responsibilities and its resulting ability to provide a bid at the true value of the timber. A bid made with the benefit of the complete knowledge of the timber obviously can be higher than bids for the same timber submitted by other potential purchasers less familiar with the particular stand of timber being considered. The high bid would receive the award. Agreements of this nature have met with good acceptance in Appalachian and Southern Hardwood forest areas. Mutual benefits

accrue to the parties: the land owner benefits through stand improvement and receives a higher return for his stumpage, and the holder of the option is able to procure selected timber without the necessity of tying up cash assets in land ownership.

Some option agreements have included the payment of annual taxes by the holder of the option. This is a worthwhile consideration that, if applied, may result in successful negotiation of an otherwise unsuccessful attempt to reach agreement with a land owner.

Leasing of forest land, when based on a long-term lease agreement, can be more advantageous than purchase. This is particularly true when viewed from the standpoint of the heavy requirement of the complex for investment capital. Leased land should be treated as land under direct ownership; forest management techniques should be applied to improve the quality of the forest stand and to increase the board foot yield per acre. The terms and cost of leasing should be carefully evaluated from the standpoint of the long-range best interest of the complex.

The use of forest management agreements to assure the availability of sawtimber is fine in theory, but it is probable that the ability to acquire stumpage in this manner will be very limited. Owners of private forest land do not readily become enthused about implementing forest management programs when they cannot see an immediate business benefit. The conduct of a management program will require reinvestment of a portion of the proceeds from sale of timber, applied to the carrying out of planting, thinning, and other management recommendations. Such a requirement for investment beyond the original cost of the acreage, plus the payment of annual taxes, provides a stumbling block in arousing the interest of a land owner in reaching an agreement. Reinvestment will require faith in the future of the market for forest products; conditions applying to the utilization of the forest crop in eastern Kentucky have not been the least bit encouraging in this respect. A record of successful performance by the processing activities of the complex and the catalytic action it may have upon establishing intensified utilization of forest resources will without doubt result in the firming up of a commodity market that the owner of timber can look toward with business interest. This is not the situation that prevails at the present time, and efforts to attract a land owner in the absence of favorable conditions in this

regard will undoubtedly meet with very limited success.

Procurement From Independent Suppliers

In acting as a purchasing agent for the complex, the subsidiary corporation will operate on a commission basis, such commission to be earned for maintaining a steady inflow of saw logs and cordwood in accord with the requirements of the complex as to species, quality, and quantity. To facilitate the development of an economic projection the rate of commission has been established at 3 percent of purchase price. While performing this service, the subsidiary should have and must apply knowledge concerning forest management, logging methods, and the transportation of forest products. It will apply its own abilities in negotiating to best advantage for deliveries of raw materials by contractors and independent sources of supply. The assignment to the subsidiary of the responsibility of procuring rough forest products will free the complex to involve itself completely with the task of processing, assuming that within its organization it has a reliable supply of raw material at acceptable cost.

Forest Management Activities

This subsidiary corporation will bear the burden of working toward improvement of the forest cover within the designated procurement area from which the complex will derive its raw materials. Corporate owned and controlled lands should be brought under a long range management program of selective cutting, improvement cutting, tree planting, and fire control. This program should be directed toward improving the average quality of saw logs and the replacement of undesirable species with those that are more valuable. The proportion of soft hardwoods in the forest stand should be increased, with emphasis placed on improving the availability of poplar and soft maple. The more valuable species in the red and white oak groups should be encouraged, and the poorer species (principally black and chestnut oaks) should be replaced when practicable. The condition of the forest cover in eastern Kentucky is in general so poor at this time that the application of any reasonably conceived and organized forest improvement program will be bound to give beneficial results. The most direct and least costly means of effect-

ing stand improvement will be for the land management corporation to insist that contract loggers apply logging methods that will assist management objectives. Assistance in applying and carrying out effective stand improvement programs can, under certain circumstances, be obtained from the Kentucky Division of Forestry. It is assumed that the corporation will work closely with this Division in working toward its established objectives.

Performance Requirements

To perform these outlined tasks, the land management corporation must necessarily be staffed by competent individuals. The principal staff requirement will be for a qualified forest engineer able to negotiate the acquisition of a suitable amount of acreage, to contract with loggers and truckers, and otherwise to negotiate the purchase of rough forest products outside of the quantities that will be obtained by contract cutting and hauling from owned or controlled acreage. The forest engineer should be assisted by a trained forester, a records clerk and a secretary. Office space will be rented from the complex.

Land Management Corporation Economic Performance Data

Daily Activities—Deliver to the complex 15,750 board feet of saw logs and 35 cords of cordwood obtained from forest land that is owned or otherwise controlled.

Procure for and have delivered to the complex 15,750 board feet of saw logs and 102 cords of cordwood from independent suppliers.

A. Annual Operating Costs:

250 day operating year

Salaries:

Forest engineer.....	\$9,000
Assistant forester.....	7,000
Records clerk.....	4,500
Secretary.....	4,000
Salary overhead 15 percent.....	3,675

Expenses:

Telephone.....	1,200
Supplies.....	1,500
Travel.....	10,000
Rent.....	720
Legal, audit and credit.....	2,000

Contract Costs:

Cutting and skidding.....	82,688
Road building	11,813
Loading and hauling.....	87,500

Equipment:

Pick-up trucks (2)—rented.....	\$1,800
Tools and supplies.....	600
Instruments (Depreciation).....	300
Office equipment (Depreciation).....	200
Interest on Investment (6 percent).....	31,200

Total Annual Cost..... \$247,032

B. Projected Annual Operating Statement:

Annual Sales (Sales to Complex):

a. 3938 thousand board feet of saw logs at \$44.00/M b.f. delivered.....	\$173,272
b. 8750 cords of cordwood at \$12.00/cord delivered.....	105,000
c. 3 percent commission earned on sale of 3937 thousand board feet of saw logs, and 25,500 cords of cordwood from independent suppliers.....	14,377

Net Sales..... \$292,649

Direct Costs:

Salaries.....	\$28,175
Expenses.....	15,420
Contract costs.....	182,001
Equipment.....	2,900
	228,496

Gross Margin..... \$64,153

Indirect Costs:

Interest on investment.....	\$31,200
Interest on working capital...	1,560
Taxes.....	3,832
	36,592

Net Profit..... \$27,561

Less—Allowance for Taxes:

Federal tax*.....	\$6,839
Kentucky tax.....	1,429
	8,268

Net Profit After Taxes..... \$19,293

C. Saw Logs Costs (per thousand board feet):

Stumpage (Average logs).....	\$20.00
Cutting and skidding.....	11.00
Road building.....	3.00
Loading and hauling.....	10.00
	44.00

Total Cost..... \$44.00

D. Cordwood Costs (per cord):

Stumpage.....	\$2.00
Cutting and skidding.....	4.50
Loading and hauling.....	5.50
	12.00

Total Cost..... \$12.00

E. Forest Land Ownership:

Investment:

26,000 acres at \$20/acre..... \$520,000

Yearly Taxes:

26,000 acres assessed at 28 percent and taxed at \$2.05/100.....	\$2,948
Fire tax 2¢/acre.....	520
Corporate license—\$.70/\$1,000.....	364

Total..... \$3,832

F. Determination of Working Capital:

Advance payments to contractors.....	\$21,000
Operating cash.....	5,000

Total..... \$26,000

*Federal depletion allowance on timber holdings not deducted. On ownership of 26,000 acres at 2,500 b.f./acre the approximate allowance will be \$15,752.

The Principal Corporation

The principal corporation will operate the major processing facilities and be responsible for the overall conduct of business of the complex. It will obtain its rough forest product raw materials through the services of its subsidiary land management corporation and sell its finished products through its subsidiary marketing corporation. In addition, it will give every possible assistance to the establishment and continued profitable operation of satellite processing units.

The General Manager

The administration of the principal corporation will be the responsibility of a general manager who is trained and experienced in business administration and who has related sales experience. It is strongly recommended that the individual selected for this position should come from outside of the lumber industry. To use an experienced manager from within the industry would undoubtedly result in modification of the recommended approach and closer conformance to the conventional procedures of wood conversion and product manufacture. Throughout this report, the point of emphasis is that the complex should not sell lumber as a product; this recommendation in itself is the principal point of difference between what is advocated by this report and what is labeled as conventional procedure within the sawmill and wood processing industry. An attempt to operate in accord with past experiences will have very little chance for success in the environment offered by eastern Kentucky.

The general manager will be the highest salaried employee of the entire organization and, in addition to receiving a salary, he should be the beneficiary of a liberal bonus or stock option plan. A bonus payment based on a value of between one and one half to two percent of net profit after taxes would provide an attractive incentive and would be a fair payment from the standpoint of all parties concerned. An exact determination of the value of such a payment must be withheld to be applied as a measure of the individual offered the position. The objective of both the recommended relatively high salary and liberal bonus is to attract the best available talent to the position. If this position is not properly filled, the opportunity for full growth and realization of the aims of the complex will be heavily jeopardized.

The administrative offices of the complex should be near the sales office operated by the marketing corporation and should probably be located at a center of population away from the actual processing facilities. The routine planning and operational responsibilities of the general manager will require close liaison with the production activity to enable a continually current working familiarity with its routine performance. The general manager will, however, delegate managerial control of processing activities to the production manager. In addition, he will be the immediate superior above the sales manager. A physical working proximity between the general manager and the sales manager should serve to intensify the responsiveness of the processing activities of the complex to recommendations evolving from sales activities. To facilitate the conduct of routine administrative activities the general manager should be aided by an administrative assistant, preferably a younger individual trained in business management.

Production Management

The production manager in addition to assuming immediate responsibility for the production performance of the complex, will operate a general business office located at the processing site. The function of this office will be to carry out the routine business of purchasing, shipping products, employment, payroll accounting, etc. This office will also be responsible for overall plant maintenance, under the direction of a maintenance coordinator. Each processing activity will perform its own preventative maintenance in accord with recommendations established and enforced by the maintenance coordinator. The actual performance of maintenance will be accomplished by competent independent organizations located in the surrounding community.

Each processing activity will be under the immediate supervision of a foreman, supervisor, or superintendent, as established in the description of manpower requirements in the preceding section. All first line supervisors will be responsible to the production manager. The degree of individual authority that the various supervisory personnel will have is implied by each job title. A foreman will have the least responsibility, and a superintendent will have the greatest range of responsibility and authority.

The Production Manager

This individual will be a key member of the management group, entitled to incentive payment as a reward for successful performance. The position should be held by a person having a record of successful management performance in processive industry. Direct experience in the wood products field will be helpful, but it is not considered to be a prerequisite to filling the position. Much of the actual detailed processing knowledge required for successful conversion of wood into products will derive from the capabilities of an assistant selected for his demonstrated experience in wood processing, and from the lower echelon of supervision. The production manager must have the ability to employ such talent and to recognize and encourage the application of that talent by others to the best advantage of the processing activities. In essence, the ideal individual to fulfill the task of production management will be one who can apply practical and persuasive direction to achieving economic manufacture of products. While the raw material, wood, is certainly influential, the proper application of fundamental principals of good management will be much more important than an involved understanding of and/or dexterity in handling the raw material.

The production manager will be one of the key personnel of the organization and as such should be included as a member of the board of directors of the principal corporation. A properly qualified individual will demand a relatively high salary and expect a yearly bonus or other incentive.

Physical Plant

To attract satellite units to the complex, as well as to house its own processing facilities, the principal corporation will provide all necessary buildings, grounds, and services. It will also serve the satellites as a dependable source of supply of reasonably priced processed raw materials. Building space should be made available to the satellites on a rental basis, thereby reducing their required investment and simplifying the task of financing that they will confront in establishing their respective production facilities. This recommendation, of course, throws the burden of providing capital for construction of buildings onto the principal corporation. Structures required to house and service the processing activities described in the previous section will involve

an estimated expenditure of \$761,300. They are identified as follows:

<i>Buildings*</i>	<i>Floor Space sq. ft.</i>	<i>Estimated Cost</i>
Sawmill.....	7,200	\$25,200
Remanufacturing plant.....	24,000	120,000
Pallet plant.....	12,800	64,000
Milled products plant.....	7,200	36,000
Flakeboard plant.....	58,000	257,500
Unassembled furniture plant.....	20,000	100,000
Furniture frame plant.....	16,000	80,000
Animal litter and mulch plant.....	10,600	38,700
Preservative treating plant.....	5,000	17,500
General office.....	3,200	22,400

*Refer to the Preliminary Plan of Processing Facilities on page 50.

Other physical plant facilities to be provided by the principal corporation include a minimum 54 acre improved site, having an estimated value of \$135,000, and a main electric sub-station, valued at \$40,000.

Economic Factors

The functions of the various processing activities operated by the principal corporation have been thoroughly discussed in previous material. The economic factors concerned with these functions are projected by the next several pages of data and information. These data are provided as guide lines to the operation of the complex and are not intended to represent an exact accounting of all of its financial involvements. Each processing unit is treated as an entity, with a consolidated operating statement combining the results of individual performances. The earnings that are predicted should easily be exceeded by the application of prudent and capable management.

Prices for sawtimber, cordwood, and rough green lumber included in the projections are carefully weighted and averaged figures premised on prevailing prices in eastern Kentucky and surrounding areas. For instance, the established value of \$44 per thousand board feet for saw logs delivered to the collection yard includes a range in price of various log grades and species from \$30 to \$80 per thousand board feet. The value of \$65 for rough green lumber from independent suppliers includes a range from \$47 to \$108 per thousand board feet. While it is possible that the basic pricing structure may rise, as a result of gradual inflation in the national economy, the relative values between the cost of raw material, the cost of production, and the market price for finished products should remain proportional. As a result of this, the earning ability of the entire complex will tend to remain near the projected level.

The cost factors for each major step in converting saw logs into kiln dried lumber are: yarding, debarking and sawing, \$15.04 per thousand board feet; and kiln drying, \$13.20 per thousand board feet.

It is to be noted that operation of the sawmill and remanufacturing activities for an additional daily shift is fully feasible. To do so will result in a decrease in production cost per unit of output, largely because fixed daily overhead charges will be prorated over the increased volume of products. In many instances it is possible to operate additional shifts with fewer employees than required during a normal daytime shift.

Although it is not specifically stated in the following projections, all selling prices for products are on an f.o.b. plant basis.

Principal Corporation Economic Performance Data

A. Responsibilities:

Provide general management and administration of all business affairs and production activities of the processing complex.

Coordinate the activities of subsidiary corporations with the overall business objectives of the organization.

Coordinate the activities and relationship of satellite processing units in conformity with the objectives of the complex.

Provide the necessary improved site and buildings for the processing facilities; assume overall responsibility for proper maintenance of production facilities; and provide watchman protection over the physical plant.

B. Administrative Office Expenses:

Annual Costs

Salaries:

General manager.....	\$18,000
Administrative assistant.....	9,000
Secretary.....	5,500
Receptionist.....	5,000
Payroll overhead (15 percent).....	5,625

Expenses:

Telephone.....	\$2,600
Supplies.....	700
Rent.....	2,400
General manager's travel.....	4,800

Equipment:

Automobile (Lease).....	\$1,200
Office equipment (Depreciation).....	500

Total Administrative Expense..... \$55,325

C. General Office Expenses:

Annual Costs

Salaries:

Production manager.....	\$15,000
Assistant to the production manager...	9,000
Secretary.....	4,000
Bookkeeper.....	6,000
Clerical assistant.....	4,500
Watchmen (2).....	8,000
Maintenance supervisor.....	7,000
Payroll overhead (15 percent).....	8,025

Expenses:

Travel.....	\$1,200
Telephone.....	2,000

Supplies.....	\$3,000
Site and building maintenance.....	35,000
Equipment:	
Pick-up truck (Lease).....	\$900
Automobile (Lease).....	1,080
Office equipment (Depreciation).....	1,000
Maintenance equipment.....	500

Total General Office Expense..... \$106,205

D. Annual Income:

Net Revenue From Processing Units:

Collection yard.....	\$14,800
Lumber manufacture.....	55,923
Air yard and dry kilns.....	104,838
Core stock manufacture.....	71,641
Dimension manufacture.....	58,871
Solid wood paneling manufacture...	290,079
Flakeboard manufacture.....	420,306

Total Revenue..... *\$1,016,458

* Detailed development provided by projected annual operating statements for each processing unit, pages 88 through 96.

E. Income From Building Rentals:

Factory Space:

Pallet plant.....	\$6,400
Unassembled furniture plant.....	10,000
Upholstered furniture frame plant...	8,000
Mulch and animal litter plant.....	5,300
Preservative treating plant.....	2,500

Office Space:

Land management corporation.....	720
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Total Rent Income..... \$32,920

F. Consolidated Annual Operating Statement:

Annual Income:

Total revenue from processing units (Schedule D).....	\$1,016,458
Income from rental of factory and office space (Schedule E).....	32,920

Net Income..... \$1,049,378

Operating Expenses:

Administrative office.....	\$55,325
General office (including maintenance of buildings and site).....	106,205

Gross Margin \$887,848

Indirect Costs:

Depreciation on buildings.....	\$50,081
Interest on investments (6 percent):	
Site and buildings.....	56,178
Working capital.....	22,326

Net Profit..... \$759,263

Less:

General manager's bonus.....	\$9,490
Production manager's bonus.....	7,590
Federal tax.....	51,453
Kentucky tax.....	339,429

Net Profit After Taxes..... \$351,301

G. Determination of Working Capital:

Administrative Office:

30 days operating expense.....	\$4,600
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General Office:

30 days operating expense.....	8,800
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Log Collection, Sorting, and Storage Yard:		
1.5 million saw log inventory.....	\$66,000	
5,700 cords.....	68,400	
Supplies.....	1,500	\$136,000
Lumber Manufacture:		
Supplies.....	1,500	1,500
Air Yard and Dry Kiln:		
1.0 million air drying inventory.....	59,040	
125 M b.f. accumulation...	7,380	
200 M b.f. in-process.....	11,808	
Supplies.....	1,500	79,750
Rough Lumber Processing:		
125 M b.f. dry lumber inventory.....	9,030	
Supplies.....	1,500	10,500
Core Stock Manufacture:		
10 days inventory.....	14,618	
Supplies.....	1,000	15,600
Dimension Manufacture:		
10 days inventory.....	28,856	
Supplies.....	1,500	30,350
Solid Wood Paneling Manufacture:		
30 M b.f. inventory.....	2,167	
10 day inventory.....	7,256	
Supplies.....	1,500	11,000
Flakeboard Manufacture:		
30 days inventory (1 shift).....	54,047	
10 days supplies.....	20,000	74,000
Total Working Capital.....		\$372,100

Interest on investment and inventories (6%)..... \$69.00

Total Daily Costs..... \$3,393.20

*Debarking of cordwood will take place for three shifts per day—see page 82.

B. Projected Annual Operating Statement

Annual Sales (internal):

a. 7875 M b.f. of mixed grade saw logs at \$47 per M b.f.—delivered to saw mill.....	\$370,125
b. 34,150 cords of debarked cordwood at \$14 per cord.....	478,100
c. 2000 tons of bark (dry) at \$1.25 per ton.....	2,500
d. 1500 units of chips at \$8.25 per unit*.....	12,375

Net Sales..... \$863,100

Direct Costs:

Labor and supervision.....	\$32,525
Electric power.....	5,000
Fuel for yard carriers.....	3,750
Supplies and maintenance...	15,000
Saw log purchases.....	346,500
Cordwood purchases.....	408,000
	810,775

Gross Margin..... \$52,325

Indirect Costs:

Depreciation.....	\$15,500
Taxes and insurance.....	4,775
Interest.....	17,250
	37,525

Net Profit..... \$14,800

*Sold to external customers.

C. Cost Factors:

Labor.....	\$2.23/hour
Supervision.....	\$3.00/hour
Payroll overhead.....	15 percent
Electric power.....	1.62¢/kw.-hr.
Saw logs.....	\$44/M b.f.
Cordwood.....	\$12/cord

Economic Performance Data for Corporate Processing Facilities

Log Collection, Sorting, and Storage Yard

Economic Performance Data

Daily activities—Receive and process 31,500 board feet of saw logs and 136 cords of cordwood.

Inventory 1.5 million board feet of saw logs and 5700 cords of cordwood.

Manufacture 6 units of chips from log ends and material not acceptable as saw logs.

A. Daily Operating Costs:

8-hour operating day, 250 day operating year.*

Saw log purchases.....	\$1,386.00
Cordwood purchases.....	1,632.00
Electric power (1235 kw.-hr.).....	20.00
Fuel for yard carriers.....	15.00
Supplies and maintenance.....	60.00
Labor (+15% overhead).....	102.50
Supervision (+15% overhead).....	27.60
Depreciation.....	62.00
Taxes (Business and property).....	12.75
Insurance.....	6.35

Lumber Manufacture Economic Performance Data

Daily Activities—Manufacture 35,000 board feet of green lumber.

Manufacture 19 units of chips.

Produce 8.6 tons (green weight) of slab suitable for manufacture into flakeboard.

A. Daily Operating costs:

8-hour operating day, 250 day operating year.

Saw log purchases.....	\$1,480.50
Electric power (2160 kw.-hr.).....	35.00
Fuel for yard carrier.....	8.00
Supplies and maintenance.....	55.00
Labor (+15% overhead).....	205.00
Supervision (+15% overhead).....	27.60
Depreciation.....	134.40
Taxes (Business and property).....	26.88
Insurance.....	13.44
Interest on investment (6%).....	80.64

Total Daily Cost..... \$2,066.40

Cost Per Thousand Board Feet of Rough Green Lumber*..... \$59.04

*Average grade, mixed species.

B. Projected Annual Operating Statement:

Annual Sales:		
a. 8,750,000 board feet of sorted and piled rough green lumber at \$59.04 per M b.f.	\$516,600	
b. 2150 tons of yellow poplar slab (green) at \$7.79 per ton	16,748	
c. 4750 units of chips at \$8.25 per unit*	39,175	
Net Sales	\$572,523	
Direct Costs:		
Labor and supervision	\$58,125	
Electric power	8,750	
Fuel for yard carrier	2,000	
Supplies and maintenance	13,750	
Saw log purchases	370,125	452,750
Gross Margin		\$119,773
Indirect Costs:		
Depreciation	\$33,610	
Taxes and insurance	10,080	
Interest on investment	20,160	63,850
Net Profit		\$55,923

*Sold to external customers.

C. Cost Factors:

Labor	\$2.23/hour
Supervision	\$3.00/hour
Payroll overhead	15 percent
Electric power	1.62¢/kw.-hr.
Saw logs	\$47/M b.f.

Air Yard and Dry Kilns
Economic Performance Data

Daily Activities – Kiln dry 25,000 board feet of lumber (with 200,000 board feet in kiln drying inventory).

Inventory one million board feet of air drying lumber.

Inventory 125,000 board feet of kiln drying accumulation.

A. Daily Operating Costs:

24-hour operating day, 350 day operating year for kilns; yard facilities will operate 1 shift, 250 days per year.	
Value of rough green lumber	\$2,066.40
Electric power (1300 kw.-hr.)	21.03
Fuel for yard carriers	20.00
Supplies and maintenance	30.00
Labor (+15% overhead)	151.70
Supervision (+15% overhead)	29.90
Depreciation	110.00
Taxes (Business and property)	22.00
Insurance	11.00
Interest on plant investment (6%)	66.00
Interest on investment in inventories (6%)	17.00

Total Daily Cost	\$2,545.03
Cost per thousand board feet of dry lumber	\$72.72

B. Daily Operating Costs—Facilities Expanded to Handle 70,000 Board Feet of Lumber per Day:

Value of Lumber:	
From internal sources	\$2,066.40
From independent suppliers	2,275.00
Electric power (2500 kw.-hr.)	40.50

Fuel for yard carriers	\$28.00
Supplies and maintenance	60.00
Labor (+15% overhead)	192.70
Supervision (+15% overhead)	29.90
Depreciation	180.00
Taxes (Business and property)	36.00
Insurance	18.00
Interest on plant investment (6%)	108.00
Interest on investment in inventories (6%)	21.95

Total Daily Cost	\$5,056.45
Cost per thousand board feet of dry lumber	\$72.24

C. Projected Annual Operating Statement:

Annual Sales:		
a. 11,250 M b.f. of sorted dry lumber at \$72.24 per M b.f. (sold internally)		\$812,700
b. 5000 M b.f. of rough dry lumber at \$90 per M b.f. (sold to satellite pallet plant)		450,000
c. 1250 M b.f. of dry lumber and core squares at \$85 per M b.f. (sold to satellite treating plant)		106,250

Net Sales	\$1,368,950
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Direct Costs:		
Labor and supervision	\$55,650	
Electric power	10,125	
Fuel for carriers	7,000	
Supplies and maintenance	15,000	
Value of rough green lumber	1,085,350	1,173,125

Gross Margin	\$195,825
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Indirect Costs:		
Depreciation	\$45,000	
Taxes and insurance	13,500	
Interest on plant investment	27,000	
Interest on inventories	5,487	90,987

Net Profit	\$104,838
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D. Cost Factors:

Labor	\$2.23/hour
Supervision	\$3.25/hour
Payroll overhead	15 percent
Electric power	1.62¢/kw.-hr.
Lumber (Internal)	59.04/M b.f.
Lumber (External)	65.00/M b.f.

Rough Lumber Processing
Economic Performance Data

Daily Activities – Process 40,000 board feet of rough dry lumber into 30,000 board feet of rough dimension products preparatory to final product manufacture.

Inventory 125,000 board feet of rough dry lumber.

A. Daily Operating Costs:

16-hour operating day, 250 day operating year.	
Value of dry lumber	\$2,889.60
Electric power (1480 kw.-hr.)	24.00
Fuel for fork lift carriers	12.00
Supplies and maintenance	30.00
Labor (+15% overhead)	492.00

Supervision (+15% overhead)*.....	\$65.73
Depreciation.....	59.00
Taxes (Business and property).....	11.84
Insurance.....	5.92
Interest on plant investment (6%).....	35.52
Interest on investment in inventories (6%).....	2.02

Total Daily Cost.....	\$3,627.65
Cost Per Thousand Board Feet of Rough Processed Dimension.....	\$120.92

*Share 1/3 of cost of general supervisor of the remanufacturing operation.

B. Projected Annual Operating Statement:

Annual Sales (Internal):	
a. 7500 M b.f. of rough processed product at \$120.92 per M b.f.....	\$906,900

Net Sales.....	\$906,900
Direct Costs:	
Labor and supervision.....	\$139,433
Electric power.....	6,000
Fuel for fork carriers.....	3,000
Supplies and maintenance...	7,500
Value of rough dry lumber...	722,400
	878,333

Gross Margin.....	\$28,567
Indirect Costs:	
Depreciation.....	\$14,750
Taxes and insurance.....	4,487
Interest on plant investment.....	8,880
Interest on inventories.....	450
	28,567

Net Profit..... *\$000,000

*Internal sales priced at cost.

C. Cost Factors:

Labor.....	\$2.23/hour
Foreman.....	\$3.00/hour
Supervisor.....	\$3.50/hour x 1/3
Payroll overhead.....	15 percent
Electric power.....	1.62¢/kw.-hr.
Rough dry lumber.....	\$72.24/M b.f.

Core Stock Manufacture Economic Performance Data

Daily Activities—Process 10,000 board feet of specially prepared rough dimension material into 8000 square feet of laminated and surfaced solid wood core stock.

A. Daily Operating Costs:

8-hour operating day, 250 day operating year.	
Value of prepared rough stock.....	\$1,209.20
Electric power (350 kw.-hr.).....	5.67
Packaging materials.....	80.00
Resin adhesive.....	10.00
Supplies and maintenance.....	10.00
Labor (+15% overhead).....	82.00
Supervision (+15% overhead)*.....	10.73
Depreciation.....	28.60
Taxes (Business and property).....	5.72
Insurance.....	2.86
Interest on plant investment (6%).....	17.00

Total Daily Cost.....	\$1,461.78
Cost Per Thousand Square Feet of Laminated Core.....	\$182.72

*Share 1/3 of cost of general supervisor of the remanufacturing operation.

B. Projected Annual Operating Statement:

Annual Sales:	
a. 2000 M sq. ft. of yellow poplar core stock at \$260 per thousand square feet.....	\$520,000
Selling Cost:	
At selling discount of 5/5/5/2.....	83,096

Net Sales..... \$436,904

Direct Costs:	
Labor and supervision.....	\$23,000
Electric power.....	1,418
Resin adhesive.....	2,500
Packaging materials.....	20,000
Supplies and maintenance...	2,500
Value of prepared rough stock.....	302,300
	351,718

Gross Margin..... \$85,186

Indirect Costs:	
Depreciation.....	\$7,150
Taxes and insurance.....	2,145
Interest on plant investment.....	4,250
	13,545

Net Profit..... \$71,641

C. Cost Factors:

Labor.....	\$2.23/hour
Supervisor.....	\$3.50/hour x 1/3
Payroll overhead.....	15 percent
Electric power.....	1.62¢/kw.-hr.
Prepared stock.....	\$120.92/M b.f.
Packaging.....	1.0¢/sq. ft.

Dimension Manufacture Economic Performance Data

Daily Activities—Process 20,000 board feet of prepared rough stock into 16,000 board feet of finished dimension and laminated products.

A. Daily Operating Costs:

8-hour operating day, 250 day operating year.	
Value of prepared stock.....	\$2,418.40
Electric power (700 kw.-hr.).....	11.34
Resin adhesive.....	15.00
Packaging materials.....	80.00
Supplies and maintenance.....	35.00
Labor (+15% overhead).....	184.50
Supervision (+15% overhead)*.....	10.73
Depreciation.....	68.00
Taxes (Business and property).....	13.60
Insurance.....	6.80
Interest on plant investment (6%).....	40.80
Interest on in-process inventory.....	1.38

Total Daily Cost..... \$2,885.55

Cost Per Thousand Square Feet of Finished Dimension..... \$180.35

*Share 1/3 of cost of general supervisor of the remanufacturing operation.

B. Projected Annual Operating Statement:

Annual Sales:	
a. 1250 M b.f. to satellite unassembled furniture plant at \$240.50 per M b.f.....	\$300,625
b. 1250 M b.f. to satellite upholstered furniture frame plant at \$223.10 per M b.f.....	278,875
c. 1500 M b.f. to open market at \$255 per M b.f.....	382,500

Less Selling Cost:		
At selling discount of 5/5/5/2.....	(153,727)	
Net Sales.....	\$808,273	
Direct Costs:		
Labor and supervision.....	\$51,307	
Electric power.....	28,350	
Resin adhesive.....	3,750	
Packaging materials.....	20,000	
Supplies and maintenance...	8,750	
Value of rough stock.....	604,600	716,757
Gross Margin.....		\$91,516
Indirect Costs:		
Depreciation.....	\$17,000	
Taxes and insurance.....	5,100	
Interest on plant investment.....	10,000	
Interest on inventories.....	345	32,645
Net Profit.....		\$58,871

C. Cost Factors:

Labor.....	\$2.23/hour
Supervision.....	\$3.50/hour x 1/3
Payroll overhead.....	15 percent
Electric power.....	1.62¢/kw.-hr.
Packaging.....	0.5¢/sq. ft.
Adhesive.....	15¢/mixed #
Rough stock.....	\$120.92/M b.f.

Solid Wood Paneling Manufacture Economic Performance Data

Daily Activities—Process 5000 board feet of selected rough dry lumber into 4000 square feet of prefinished solid wood paneling.

Inventory 30,000 board feet of select dry lumber.

A. Daily Operating Costs:

8-hour operating day, 250 day operating year.	
Value of selected stock.....	\$361.20
Electric power (615 kw.-hr.).....	9.97
Finish coating.....	80.00
Packaging materials.....	40.00
Fuel for fork lift carrier.....	7.00
Supplies and maintenance.....	20.00
Labor (+15% overhead).....	82.00
Supervision (+15% overhead).....	29.90
Depreciation.....	50.00
Taxes (Business and property).....	10.00
Insurance.....	5.00
Interest on plant investment (6%).....	30.00
Interest on investment in inventories (6%).....	.49

Total Daily Cost.....	\$725.56
Cost Per Thousand Square Feet of Finished Paneling.....	\$181.39

B. Projected Annual Operating Statement:

Annual Sales:	
a. 1 million square feet of high grade prefinished hardwood paneling in modular packages at \$350 per thousand square feet.....	\$350,000
Less Selling Cost:	
At selling discount of 5/5/5/2.....	(59,921)
Net Sales.....	\$290,079
Direct Costs:	
Labor and supervision.....	\$29,750
Electric power.....	2,493

Fuel for carriers.....	\$1,750
Finish coating.....	20,000
Packaging materials.....	10,000
Supplies and maintenance...	5,000
Value of select stock.....	90,300
	\$159,293
Gross Margin.....	\$130,786
Indirect Costs:	
Depreciation.....	\$12,500
Taxes and insurance.....	3,750
Interest on plant investment.....	7,500
Interest on inventories.....	123
	28,873
Net Profit.....	\$106,913

C. Cost Factors:

Labor.....	\$2.23/hour
Supervision.....	\$3.25/hour
Payroll overhead.....	15 percent
Electric power.....	1.62¢/kw.-hr.
Finish coating.....	2¢/sq. ft.
Packaging.....	1¢/sq. ft.
Select stock.....	\$72.24/M b.f.

Flakeboard Manufacture Economic Performance Data

Daily Activities—Process 93 cords of green bark-free cordwood and 8.6 tons of green sawmill residue into 67,500 square feet of 3/4" thick 3-layer flakeboard at a density of 40 pounds per cubic foot.

Inventory 1 million square feet of in-process and warehoused product.

A. Daily Operating Costs:

24-hour operating day (22.5 productive hours), 300 day operating year.	
Value of cordwood.....	\$1,302.00
Value of sawmill residue.....	72.45
Resin binder.....	1,489.00
Sizing material.....	84.00
Fuel oil for dryer and steam plant.....	97.50
Electric power (15,000 kw.-hr.).....	243.00
Fuel for fork lift carriers.....	20.00
Packaging.....	142.50
Supplies and maintenance.....	150.00
Labor and supervision (+15% overhead).....	902.83
Depreciation.....	467.00
Taxes (Business and property).....	93.40
Insurance.....	46.70
Interest on plant investment (6%).....	280.00
Interest on investment in inventories (6%).....	14.60

Total Daily Cost.....	\$5,404.98
Cost Per Thousand Square Feet of 3-Layer Flakeboard (3/4" thick).....	\$80.07

B. Projected Annual Operating Statement:

Annual Sales:	
a. 20,250 million square feet of 3/4" thick, 3-layer flakeboard at a density of 40 pounds per cubic foot—at \$120 per thousand square feet.....	\$2,430,000
Less Selling Cost:	
At selling discount of 5/5/5/2.....	(388,250)
Net Sales.....	\$2,041,750
Direct Costs:	
Labor and supervision.....	\$270,849

Electric power.....	\$72,900	
Resin binder.....	446,700	
Sizing material.....	25,200	
Fuel for carriers.....	6,000	
Fuel oil.....	29,250	
Packaging.....	42,700	
Supplies and maintenance.....	45,000	
Wood raw material.....	412,335	\$1,350,934
Gross Margin.....		\$690,816
Indirect Costs:		
Depreciation.....	\$140,100	
Taxes and insurance.....	42,030	
Interest on plant investment.....	84,000	
Interest on inventories.....	4,380	270,510
Net Profit.....		\$420,306
C. Cost Factors:		
Labor.....	\$2.23/hour	
Foreman.....	\$3.00/hour	
Supervision.....	\$3.25/hour	
Superintendent.....	\$10,000/yr.	
Binder (Solids).....	12.5¢/pound	
Size (Emulsion).....	9.5¢/pound	
Electric power.....	1.62¢/kw.-hr.	
Fuel oil.....	7.5¢/gallon	
Cordwood.....	\$14/cord	
Slab (Green).....	\$7.79/ton	
Packaging.....	0.25¢/sq. ft.	

Satellite Processing Units

A development of the organization and administration of the recommended satellite processing units is outside the scope of this report. However, in encouraging their formation, the management of the complex should be conscious of the manner in which these factors will influence the ability of any one satellite to achieve a healthy business stature. The satellites will be fully independent businesses, but their success or failure will have significant impact on the entire complex.

The economic performance of satellite units described in Section III has been projected to provide data that will substantiate the business potential of each. This data is included on pages 97 through 101.

In reviewing the data, it will be noted that each satellite will be charged a substantial mark-up above the cost of manufacturing the raw materials that they will require. In spite of this, they can be supplied by the complex at costs considerably below the cost of comparable materials purchased f.o.b. destination from sources outside the complex. This, truly, is an advantage to both parties; the complex will benefit by its ability to convert lumber otherwise unsuited for commercial sale into good raw material for the satellites. Without this internal source of consumption, the cost of production encountered in each processing step of the complex

would be appreciably increased as the result of a much higher waste factor.

Pallet Manufacture Economic Performance Data

Daily Activities—Process 20,000 board feet of rough dry lumber into an average of 1,666 pallets (10.2 board feet each).

A. Daily Operating Costs:

8-hour operating day, 250 day operating year.

Value of rough dry lumber.....	\$1,800.00
Electric power (1100 kw.-hr.).....	17.82
Fuel for fork lift carriers.....	10.00
Supplies and maintenance.....	50.00
Labor (+ 15% overhead).....	382.00
Supervision (+ 15% overhead).....	27.60
Depreciation.....	48.40
Rent.....	25.60
Administration.....	96.00
Taxes.....	9.68
Insurance.....	4.84
Interest on plant investment.....	29.04
Interest on investment in inventories...	4.32

Total Daily Costs	\$2,451.30
Cost of Average Pallet.....	\$1.47

B. Projected Annual Operating Statement:

Annual Sales:	
416,666 pallets at an average selling price of \$2 per pallet.....	\$833,332
Selling Cost:	
At selling discount of 5/5/5/2.....	133,141
Net sales.....	\$700,191
Direct Costs:	
Labor and supervision.....	\$88,900
Electric power.....	4,455
Fuel for carriers.....	2,500
Supplies and maintenance...	12,500
Value of rough dry lumber...	450,000
	558,355
Gross Margin.....	\$141,836
Indirect Costs:	
Administration.....	\$24,000
Rent.....	6,400
Depreciation.....	12,100
Taxes and insurance.....	3,630
Interest on plant investment.....	7,260
Interest on inventories.....	1,080
	54,470
Net Profit.....	\$87,366
Less—Allowance for Taxes:	
Federal tax.....	\$35,760
Kentucky tax.....	5,616
	41,376

Net Profit After Taxes..... \$45,990

C. Determination of Working Capital:

15 days of processed inventory.....	\$36,770
10 days of operating supplies.....	1,500
200,000 bf of yard inventory.....	18,000

Total Working Capital..... \$56,270

D. Cost Factors:

Labor.....	\$2.23/hour
Payroll Overhead.....	15 percent
Supervision.....	\$3.00/hour
Electric Power.....	1.62¢/kw.-hr.
Rough Dry Lumber.....	\$90.00/M b.f.

Unassembled Furniture Manufacture (Satellite Operation)

Economic Performance Data

Daily Activities—Process 5,000 board feet of dimension components and 4,000 square feet of flakeboard into an average of 500 pieces of furniture.

A. Daily Operating Costs:

8-hour operating day, 250 day operating year.	
Value of veneer assemblies.....	\$400.00
Value of dimension components.....	1,202.50
Value of flakeboard.....	480.00
Electric power (1,100 kw.-hr.).....	17.82
Fuel for fork lift carriers.....	5.00
Adhesive.....	15.00
Lacquer.....	22.00
Supplies and maintenance.....	35.00
Labor (+ 15% overhead).....	348.50
Supervision (+ 15% overhead).....	27.60
Depreciation.....	64.00
Rent.....	40.00
Administration.....	96.00
Taxes.....	12.80
Insurance.....	6.40
Interest on plant investment.....	38.40

Total Daily Costs..... \$3,211.02

Cost of Furniture Per Unit..... \$6.42

B. Projected Annual Operating Statement:

Annual Sales:
125,000 pieces of furniture at an average selling price of \$7.70 per piece..... \$962,500

Selling Cost:
At selling discount of 5/5/5/2..... 153,778

Net Sales..... \$808,722

Direct Costs:
Labor and supervision..... \$94,025
Electric power..... 4,455
Fuel for carriers..... 1,250
Adhesive..... 3,750
Lacquer..... 5,500
Supplies and maintenance... 8,750
Value of raw materials..... 520,625 632,855

Gross Margin..... \$175,867

Indirect Costs:
Administration..... \$24,000
Rent..... 10,000
Depreciation..... 16,000
Taxes and insurance..... 4,800
Interest on plant investment..... 9,600 64,400

Net Profit..... \$111,467

Less—Allowance for Taxes:
Federal tax..... \$47,413
Kentucky tax..... 7,307 54,720

Net Profit After Taxes..... \$56,747

C. Determination of Working Capital:

20 days of processed inventory..... \$64,220
10 days of operating supplies..... 1,000

Total Working Capital..... \$65,220

D. Cost Factors:

Labor..... \$2.23/hour
Supervision..... \$3.00/hour
Payroll overhead..... 15 percent
Electric power..... 1.62¢/kw. = hr.
Adhesive..... 15¢/mixed pound

Lacquer..... 2¢/sq. ft.
Dimension..... \$240.50.
Flakeboard..... \$120/M sq. ft.
Veneer (face and back)..... 10¢ sq. ft.

Upholstered Furniture Frames (Satellite Operation)

Economic Performance Data

Daily Activities—Process 5000 board feet of rough dimension products into an average of 450 furniture frames.

A. Daily Operating Costs:

8-hour operating day, 250 day operating year.	
Value of rough dimension.....	\$1,115.49
Electric power (900 kw.-hr.).....	14.58
Fuel for fork lift carriers.....	5.00
Supplies and maintenance.....	28.00
Labor (+ 15% overhead).....	266.50
Supervision (+ 15% overhead).....	27.60
Depreciation.....	35.60
Rent.....	32.00
Administration.....	80.00
Taxes.....	7.12
Insurance.....	3.56
Interest on plant investment.....	21.60

Total Daily Cost..... \$1,637.05

Cost of Furniture Frames Per Unit..... \$3.64

B. Projected Annual Operating Statement:

Annual Sales:
112,500 furniture frames at an average selling price of \$4.85..... \$545,625

Selling Cost:
At selling discount of 5/5/5/2..... 87,175

Net Sales..... \$458,450

Direct Costs:
Labor and supervision..... \$73,525
Electric power..... 3,645
Fuel for carriers..... 1,250
Supplies and maintenance... 7,000
Value of raw material..... 278,873 364,293

Gross Margin..... \$94,157

Indirect Costs:
Administration..... \$20,000
Rent..... 8,000
Depreciation..... 8,900
Taxes and insurance..... 2,420
Interest on plant investment..... 5,400 44,720

Net Profit..... \$49,437

Less—Allowance for Taxes:
Federal tax..... \$17,418
Kentucky tax..... 2,961 20,379

Net Profit After Taxes..... \$29,058

C. Determination of Working Capital:

10 days of processed inventory..... \$16,500
10 days of operating supplies..... 500

Total Working Capital..... \$17,000

D. Cost Factors:

Labor..... \$2.23/hour
Supervision..... \$3.00/hour
Payroll overhead..... 15 percent
Electric power..... 1.62¢/kw.-hr.
Dimension..... \$223.10/M b.f.

Animal Litter and Bark Mulch (Satellite Operation) Economic Performance Data

Daily Activities—Process 8 tons of bark (dry weight) into mulch.

Process 20 cords of green roundwood and 12 tons of shavings (dry weight) into baled or packaged litter.

A. Daily Operating Costs:

16-hour operating day, 250 day operating year.

Value of bark.....	\$10.00
Value of shavings.....	15.00
Value of cordwood.....	280.00
Electric power (1600 kw.-hr.).....	25.92
Fuel oil for dryer.....	36.00
Fuel for fork lift carriers.....	12.00
Chemical additive for mulch.....	14.40
Bags for mulch.....	48.00
Bags for wood particles.....	30.00
Supplies and maintenance.....	50.00
Labor (+ 15 % overhead).....	164.00
Supervision (+ 15% overhead).....	55.20
Depreciation.....	49.00
Rent.....	21.00
Administration.....	96.00
Taxes.....	9.80
Insurance.....	4.90
Interest on plant investment.....	29.40

Total Daily Cost.....\$950.02

Cost Per Pound of Product.....1.19¢

B. Projected Annual Operating Statement:

Annual Sales:

167,000 cubic feet of bark mulch at 40¢/cu. ft.....	\$66,800
96,000 cubic feet of particle type litter at 25¢/cu. ft.....	24,000
255,750 bales of shavings (60 pounds per bale) at 90¢/per bale.....	230,175

Selling Cost:

At selling discount of 5/5/5/2.....51,283

Net Sales.....\$269,692

Direct Costs:

Labor and supervision.....	\$57,250
Electric power.....	6,480
Fuel for dryer.....	9,000
Fuel for carriers.....	3,000
Bags for packaging.....	19,500
Chemical additive.....	3,600
Supplies and maintenance...	12,500
Value of raw materials.....	76,250
	187,580

Gross Margin.....\$82,112

Indirect Costs:

Administration.....	\$24,000
Rent.....	5,300
Depreciation.....	12,250
Taxes and insurance.....	3,675
Interest on plant investment.....	7,350
Interest on inventories.....	1,250
	53,825

Net Profit.....\$28,287

Less—Allowance for Taxes:

Federal tax.....	\$7,190
Kentucky tax.....	1,480
	8,670

Net Profit After Taxes.....\$19,617

C. Determination of Working Capital:

30 days of processed inventory.....\$28,500

10 days of operating supplies.....\$1,400

Total Working Capital.....\$29,900

D. Cost Factors:

Labor.....	\$2.23/hour.
Supervision.....	\$3.00/hour.
Payroll overhead.....	15 percent.
Electric power.....	1.62¢/kw.-hr.
Fuel oil.....	9.5¢/gallon.
Bark.....	\$1.25/ton.
Shavings.....	\$1.25/ton.
Cordwood.....	\$14.00/cord.

Preservative Treated Products Economic Performance Data

Daily Activities—Process 5 cords of cordwood and 5000 board feet of lumber and squares into treated products.

A. Daily Operating Costs:

8-hour operating day, 250 day operating year.

Value of cordwood.....	\$70.00
Value of sawn products.....	425.00
Electric power (700 kw.-hr.).....	11.34
Chemical preservative.....	124.00
Fuel for carriers.....	6.00
Oil for steam generator.....	7.68
Supplies and maintenance.....	20.00
Labor (+ 15% overhead).....	82.00
Supervision (+ 15% overhead).....	27.60
Depreciation.....	26.00
Rent.....	10.00
Administration.....	26.00
Taxes (Not income).....	5.20
Insurance.....	2.60
Interest on plant investment.....	15.60

Total Daily Cost.....\$905.02

Cost of Treating Per Thousand Square Feet.....\$41.00

B. Projected Annual Operating Statement:

Annual Sales:

25,000 treated and machined fence posts at \$1.20 each, and 600 thousand board feet of treated fence rails at \$168/M b.f.....	\$130,800
750 thousand board feet of treated lumber and square posts at \$168/M b.f.....	126,000
312 thousand board feet of treated poles at \$143/M b.f*.....	44,616

Selling Cost:

At selling discount of 5/5/5/2.....48,029

Net Sales.....\$252,587

Direct Costs:

Labor and supervision.....	\$29,900
Electric power.....	2,835
Chemical preservative.....	31,000
Oil for steam.....	1,920
Fuel for carriers.....	1,500
Supplies and maintenance...	5,000
Value of wood.....	123,750
	195,905

Gross Margin.....\$56,682

Indirect Costs:

Administration.....	\$18,000
Rent.....	2,500
Depreciation.....	6,500
Taxes and insurance.....	1,950

Interest on investment and inventories.....	\$6,200	\$35,150
Net Profit.....		\$21,532
Less—Allowance for Taxes:		
Federal tax.....	\$5,114	
Kentucky tax.....	1,077	6,191
Net Profit After Taxes.....		\$15,341
*\$12 for average 8" diameter pole 20 feet in length.		
<i>C. Determination of Working Capital:</i>		
30 days of processed inventory.....		\$27,150
10 days of operating supplies.....		2,250
Total Working Capital.....		\$29,400
<i>D. Cost Factors:</i>		
Labor.....	\$2.23/hour	
Supervision.....	\$3.00/hour	
Payroll overhead.....	15 percent	
Electric power.....	1.62¢/kw.-hr.	
Preservative.....	34¢/pound	
Fuel oil.....	16¢/gallon	
Cordwood.....	\$14.00	
Lumber and squares.....	\$85.00	

The Marketing Corporation

All products manufactured by the principal corporation and satellite units of the complex and destined for external sale will be sold by the subsidiary marketing corporation. Concurrently with the discharge of the principal assignment, the corporation will, on behalf of the complex, perform customer services, sponsor limited product development, assist the production units in meeting customer requirements, and conduct advertising and public relations activities.

In fulfilling its principal assignment, the corporation will maintain a sales office at a central location apart from the processing activities of the complex. Lexington is highly favored as a location both because of its proximity to eastern Kentucky and because its well developed transportation and communications facilities make it accessible from major market centers. Convenient transportation to and from the sales office is important to customers as well as to the sales force and other organizations that may participate in the sale of products manufactured by the complex. In view of expected visits by principal customers, the office should be combined with an attractively appointed product display room. As explained in the discussion of the principal corporation, the sales office should be located adjacent to the quarters occupied by the administrative office of the complex, in the interest of achieving the maximum effective liaison between marketing and processing activities.

Organization and Activity

The marketing corporation should be staffed with clerical personnel and a force of field sales representatives under the direction of a sales manager. The clerical staff will process orders and sales, maintain records, prepare correspondence, and otherwise perform routine duties involved in the conduct of business. The sales representatives will procure orders and provide technical assistance to customers. They should be salaried employees of the corporation, not entitled to a commission on sales. Consideration should, however, be given to augmenting the salary of each representative with an incentive bonus based upon sales achievement. They should be provided with leased automobiles by the corporation to be used in field sales work. The combined selling efforts of the sales manager and his force of sales representatives will be augmented by sales through distributors.

The field service representatives, as the name implies, should be permanently located in the field at key points about the sales territory. The projection of the economic activity of this corporation has allowed for five representatives. A logical division of the sales territory to be served by the complex would justify location of one man in western North Carolina, one in western Virginia, one in northeastern Ohio, and one in southeastern Illinois. The fourth man should work from the sales office and provide sales coverage within Kentucky.

It is expected that up to one-third of the total sales volume will be moved through wholesale distributors. Efforts should be made to keep this volume at a minimum. The channeling of some products through distributors could well exceed the one-third level; this situation would be balanced by the movement of the total output of other products direct to customers. Most distributors will operate on a discount schedule of 5%-3%-2% cash, provided they are not required to maintain warehouse inventories of products or to extend credit. They will, in effect, be order takers able to develop business to the advantage of the complex. Their utility to the sales corporation will lie in their ability to augment the field sales force, without fixed expenditures for salaries and overhead.

The major portion of the sale of products will develop through the activities of the field representatives. The location of these representatives, at strategic points about the sales territory, as suggested above, will

facilitate their ability to maintain close contact with customers. The additional service of technical assistance is a means of cultivating customer relations, as well as a means of assuring proper adaption of the products, production capacity, and skills of the complex to the needs of the customer. The "personal element" evolved through the extension of field service is effective and is the equivalent of a great deal of costly advertising. The service extended to any one customer should be tempered by the volume of business, actual or potential, that is involved.

The field representatives will be able to detect needs for product changes and to suggest new products that might be manufactured to advantage by the complex. In these instances, the representatives will communicate recommendations to the processing activity. In this same vein, there will be opportunities for the sales representatives to work with some customers in matters of new product development. While each situation involving product development must be judged upon its own merits, the attitude of the sales representative should be to encourage or perhaps participate in programs of which he has knowledge. The primary mission of the field representatives will be to consummate the sale of products. The extent of participation in any supplemental activity should, therefore, be judged accordingly.

The diverse nature of the planned product line of the complex will require selling to a rather broad spectrum of industrial and consumer markets. Solid wood core stock, flakeboard, and dimension will move primarily to the furniture industry. Solid wood paneling will sell to wholesale and retail lumber yards and contractors. Pallets will be sold wherever there is transfer and storage of quantities of materials—both in warehousing and in manufacturing. Furniture frames will be directed only to manufacturers of upholstered furniture. Unassembled furniture will sell to large merchandising establishments and chain retailers. Litter and mulch will sell to warehouse distributors, with considerable movement of products direct to volume consumers. Preservative treated products will sell to industrial consumers, retailers, and individual volume users, such as stock farms.

The marketing corporation should function as a factory representative, with an f.o.b. plant pricing policy. Shipments will originate at the producing facility; the sales office will maintain no inventories of products

and will perform no retail sales function. Products rejected as a result of errors in machining or manufacture are suitable for sale, provided they are clearly identified as being seconds—by stamping or other marking on each piece. On the other hand, products evidencing technical defects, such as faulty glue lines in laminated stock or inferior physical properties in flakeboard, should be destroyed. The marketing corporation should monitor the processing activities to insure that policies of the complex relating to the disposal of reject material are followed. It should act as the conscience of the entire organization, insisting that all its markets be supplied with nothing but quality products.

Sales personnel should be made thoroughly familiar with the methods of manufacture and properties of the products that they are responsible for selling. Each man added to the sales force should be subjected to a period of formal familiarization—including, among other things, several days of on-site observation and training at the production facility.

Pricing

Prices for products will be established by the manufacturing sources: either the principal corporation or the satellite units. In serving as the selling agent, the marketing corporation should apply a 5%/5%/5%/2% cash discount against the established price. This discount will be the total source of revenue for the marketing corporation.

If prices are found to offer a competitive disadvantage, the need for changes will be negotiated between the source and selling agent—i.e., the marketing corporation. As a matter of policy to be practiced by the entire complex, prices should not be permitted to deviate to any appreciable extent from those charged by competitive sources of identical products. The use of below market prices or unusual discounting from published price lists as a competitive weapon should be avoided; instead, preference should be given to developing a reputation for quality and service.

In the event that closing of a large order is contingent upon accepting a price below list, final acceptance of the order (and the price) should lie with the product source. This procedure is particularly important with regard to the sale of products for satellite units. Although acceptance of an unusually low price should not involve any change in the marketing corporation's discount schedule, it will result in reduced revenue because

the discount will apply to a lower selling price.

Promotional Activities

Advertising and other means of placing the product line in front of the potential customer will be the sole responsibility of the marketing corporation. A sufficient selling discount has been recommended to permit an effective advertising and publicity effort. Extensive use should be made of trade magazine advertising and promotional literature designed for direct mailing and hand distribution by sales representatives and distributors.

In the event of unusual or specifically directed advertising efforts undertaken for the benefit of a particular satellite or processing facility, the beneficiary should assist the marketing corporation in meeting costs.

Whenever practicable, products should be packaged for shipment to customers. In all instances the packaging should be designed to assist the overall effort to advertise; it should also serve to identify the product with the complex. Advertising applied to packaging should be designed with the assistance of the marketing corporation; and the cost of such advertising should be charged as a production expense, not as a sales expense, and should be borne by the production unit.

The display room to be maintained in conjunction with the sales office should be interesting and impressive so that it can serve as a practical aid to selling. The presence of a complex of the type advocated, will, over a period of time, attract many visitors. A properly designed display room will leave these visitors, many presumably potential customers, with a lasting favorable impression that will contribute enormously to easing follow-up selling effort. Some expenses of the display room should be borne by the processing units, to the extent that they will donate materials for display. Most other expenses will rightfully be the responsibility of the marketing corporation.

Incentive to Satellite Units

In recognition of the contribution of the satellite units to the saleability of their products, the marketing corporation could to its own advantage make available an incentive bonus to any satellite whose products sell in excess of a certain dollar volume over a period of time. An equitable means of giving a bonus would be by reducing the

established discount schedule. An alternative method would be to make a lump sum payment, based on a percentage of gross profit of the marketing corporation. The percentage rate would be established in accord with a schedule based on the relationship of unit price to volume. This alternative would be less desirable than a reduction in the discount schedule because it would serve to acquaint others too intimately with details of the conduct of business by the marketing organization.

The Sales Manager

The proper discharge of the multiple functions of the marketing corporation will be the responsibility of a sales manager. The individual selected for this position should be eminently qualified, with a background that combines selling and management experience. As in the case of the production manager, a thorough familiarity with the sale of wood products is desirable but not mandatory. The manager will depend upon his staff of technically qualified sales representatives when dealing with technical problems related to the nature or application of individual products. His major objective will be to develop sales volume to an extent that will permit operation of the various processing units of the complex at their optimum capacities. In accomplishing this objective, he will be heavily involved in tasks of planning, rendering policy decisions, cultivating distributor outlets, maintaining customer relations at the decision level, and coordinating marketing requirements with activities of the processing facilities of the complex.

It is fully expected that the sales manager will also engage in direct selling, particularly with regard to the development of major new accounts. Ordinarily, his contacts with customers will be preceded by ground-work by his staff of field representatives. He should also be available to his representatives to assist in closing unusual, difficult, or highly important sales.

In addition to his selling tasks, the sales manager will establish clerical procedures, respond to customer demands, and administer the extension of credit and other routine business involvements.

The sales manager will be a key member of the management echelon of the entire complex. As such, he will be included on the board of directors of the principal corporation. This recommendation is in keeping with the importance that should be accorded

to the influence of the sales organization upon the conduct of product manufacture by the complex. An individual of the caliber required to perform the described job in a proper manner will command a comparatively high salary and will probably expect to receive a performance award. Accordingly, it is recommended that an incentive payment should be made available—possibly of the nature of 1.25 percent of net profit of the marketing corporation.

Economic Performance

The economics applying to the function described above are projected on the following four pages. Gross sales revenue is projected at \$6.5 million, with net sales at \$1.042 million. Annual operating costs will be \$421 thousand.

Marketing Corporation

Economic Performance Data

Daily Activities—Perform all external sales of products manufactured by the complex and its satellite processing operations.

Conduct advertising, customer service and public relations activities on behalf of the complex.

Maintain a sales display room.

A. Annual Operating Costs:

Salaries:	
Sales manager.....	\$15,000
Sales representatives (5).....	50,000
Sales clerks (2).....	12,000
Secretaries (2).....	9,000
Payroll overhead 15 percent.....	12,900

Expenses:	
Discounts to distributors.....	211,194
Manager's travel.....	12,000
Sales representatives' travel.....	30,000
Advertising budget.....	40,000
Sales aids.....	5,000
Telephone.....	6,000
Supplies.....	1,500
Insurance.....	1,700
Rent.....	3,600
Legal, audit, and credit.....	3,000

Equipment:	
Leased automobiles (5).....	6,000
Office equipment (Depreciation).....	2,000

Total Cost..... \$420,894

B. Annual Sales Activity:

Annual Sales Revenue:			
Product	Quantity	Unit Price	Cost
Solid wood	2,000,000	\$260/M	\$520,000
core stock.	sq. ft.	sq. ft.	
Dimension	1,500,000	\$255/M	382,500
products.	b.f.	b.f.	
Solid wood	1,000,000	\$250/M	350,000
paneling.	sq. ft.	sq. ft.	

Flakeboard	19,250,000	\$120/M	\$2,310,000
(3/4"-40#).	sq. ft.	sq. ft.	
Pallets.....	416,666	\$2/pallet...	833,332
	pallets.		
Unassembled furniture.	125,000	\$7.70/piece.	962,500
Upholstered furniture frames.	112,500	\$4.85/frame.	545,625
Treated products.	25,000	\$1.12/post.	27,500
	posts.		
	600 M b.f.	\$168/M b.f.	100,800
	fence rails.		
	750 M b.f.	\$168/M b.f.	126,000
	lumber & posts.		
	312 M b.f.	\$143/M b.f.	44,616
Litter.....	255,750	90 /bale...	230,175
	bales shavings.		
	96,000	25¢/cu. ft.	24,000
	cu. ft. particles.		
Bark mulch.	167,000	40¢/cu. ft.	66,800
	cu. ft.		

Gross Sales Revenue.....	\$6,523,848
Selling Commission:	
At selling commission of 5/5/5/2.....	\$1,042,315

C. Projected Annual Operating Statement:

Annual Sales:	
Gross revenue from schedule "C"...	\$6,523,848
Selling Cost:	
Cost of products sold.....	5,481,533

Net Sales..... \$1,042,315

Direct Costs:	
Salaries.....	\$98,900
Expenses.....	313,994
Equipment.....	8,000
	420,894

Gross Margin..... \$621,421

Indirect Costs:	
Interest on working capital.....	\$13,740
	13,740

Net Profit..... \$607,681

Less:	
Sales manager's bonus.....	
Federal tax.....	284,230
Kentucky tax.....	41,506
	333,333

Net Profit After Taxes..... \$274,348

D. Discounts to Distributors:

Assume 33 percent of total sales are performed through wholesale distributors at a discount of 5/3/2 on a gross sales revenue of \$6,602,515.....	\$211,194
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E. Determination of Working Capital:

30 days accounts receivable for products derived from satellite units.....	\$213,000
Operating cash.....	16,000

Total Working Capital..... \$229,000

Section V

Site Analyses

Requirements of the Complex

The selection of a suitable site for the processing activities of the complex will heavily influence the success of the proposed venture. Many of the factors that influence site selection have been discussed in some detail in this report (see especially Section I) and in the earlier Phase II Report produced during the same study program. These general criteria have been applied to the analysis of three areas in eastern Kentucky that appear to be suitable locations for the complex. In accordance with the terms of reference of the study program, however, no attempt has been made to render a final decision on any of these areas—or the industrial sites situated within each area—as the best location for the complex. Such a decision can only be made, in the final analysis, by the group responsible for initiating the venture.

Map V-I shows the three areas discussed in this section. Each area is defined by a circular procurement area with a radius of 50 miles. Within the three areas, ten possible industrial sites have been identified. The salient features of each area and site are described below; the location and configuration of each potential site are shown by topographic maps.

Area 1—Kentucky River Valley

This area, centering at Irvine, occupies 5450 square miles within the confines of eastern Kentucky and contains 2,477,000 acres of forest land. The total forest resources in the area comprise 6.1 billion board feet of sawtimber and 10.3 million cords of cordwood. The wood raw material available annually for use by new industry is:

Saw timber.....	176,276 thousand board feet.
Cordwood.....	910,000 cords.

That portion of the procurement radius which extends outside of eastern Kentucky and into the Bluegrass region has been disregarded as a source of raw material. It is

possible, however, that it can be developed as a limited source of quality saw logs and veneer bolts. The area is particularly favored because of its access by rail transportation to Chillicothe, Ohio—an advantage in the sale of pulp chips.

Area Facilities

The area is served by the Eastern Kentucky Division of the Louisville and Nashville Railway. A major marshalling yard is located at Irvine. Rail transit times from Irvine–Ravenna are 6½ hours to Louisville, 20 hours to Cincinnati, and 26½ hours to Knoxville.

State Highway Routes 52, 89, and 499 serve Irvine–Ravenna; State Routes 52 and 11 serve Beattyville. Irvine is 15 miles from the East Kentucky Turnpike, one section of which is scheduled to be completed in 1962, and about 20 miles from the route of I-75 (Knoxville–Lexington–Cincinnati), scheduled for 1964–70. Beattyville is 27 miles from the turnpike. Highway distances from Irvine and Beattyville, respectively, are: 129 and 151 miles to Cincinnati, 117 and 154 miles to Louisville, and 189 and 217 miles to Knoxville.

Electric power is supplied by the Kentucky Utilities Company. Natural gas is supplied to Irvine and Ravenna by Columbia Gas of Kentucky; it is not available to Beattyville.

Available Sites

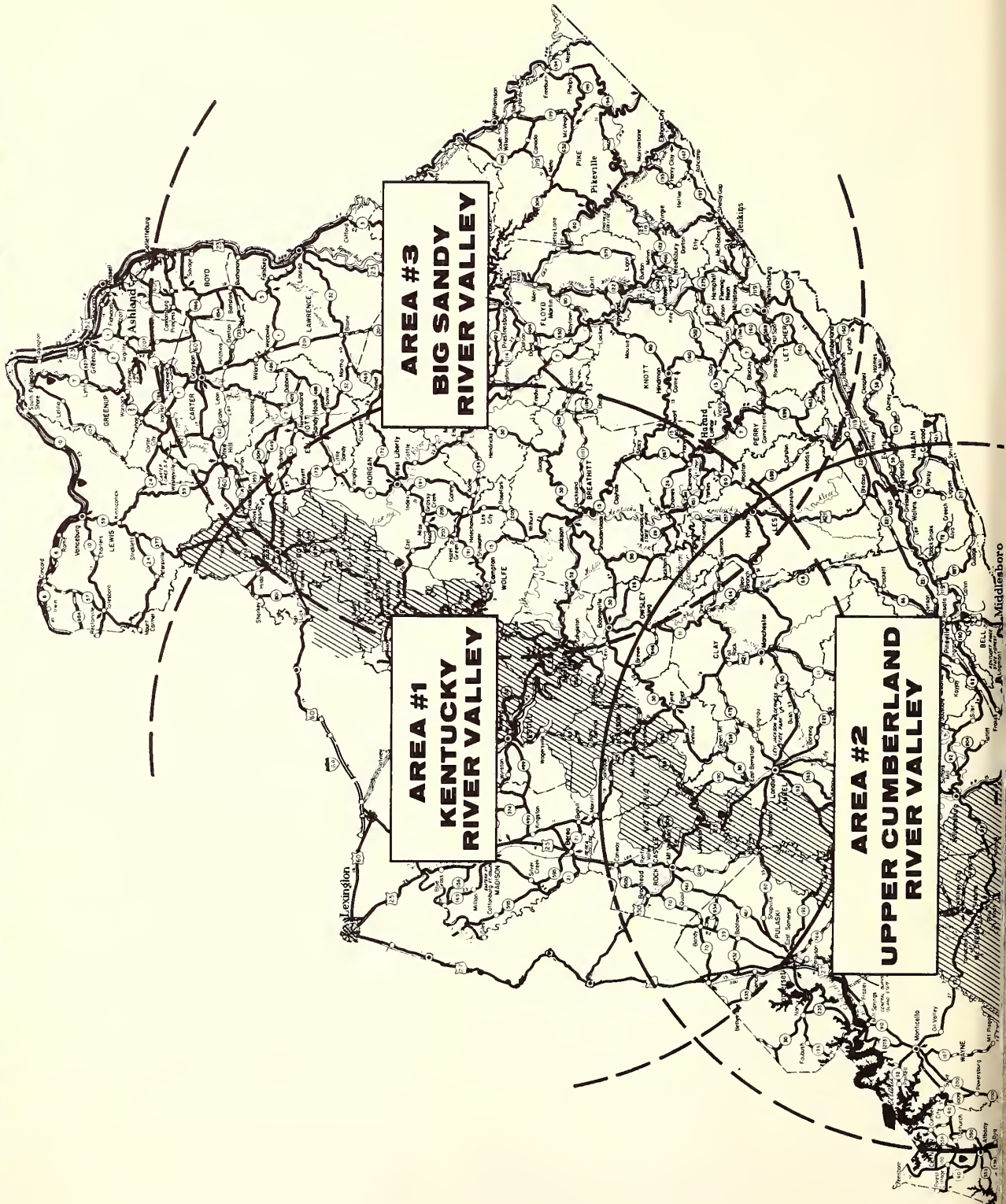
Three sites have been selected within this area:

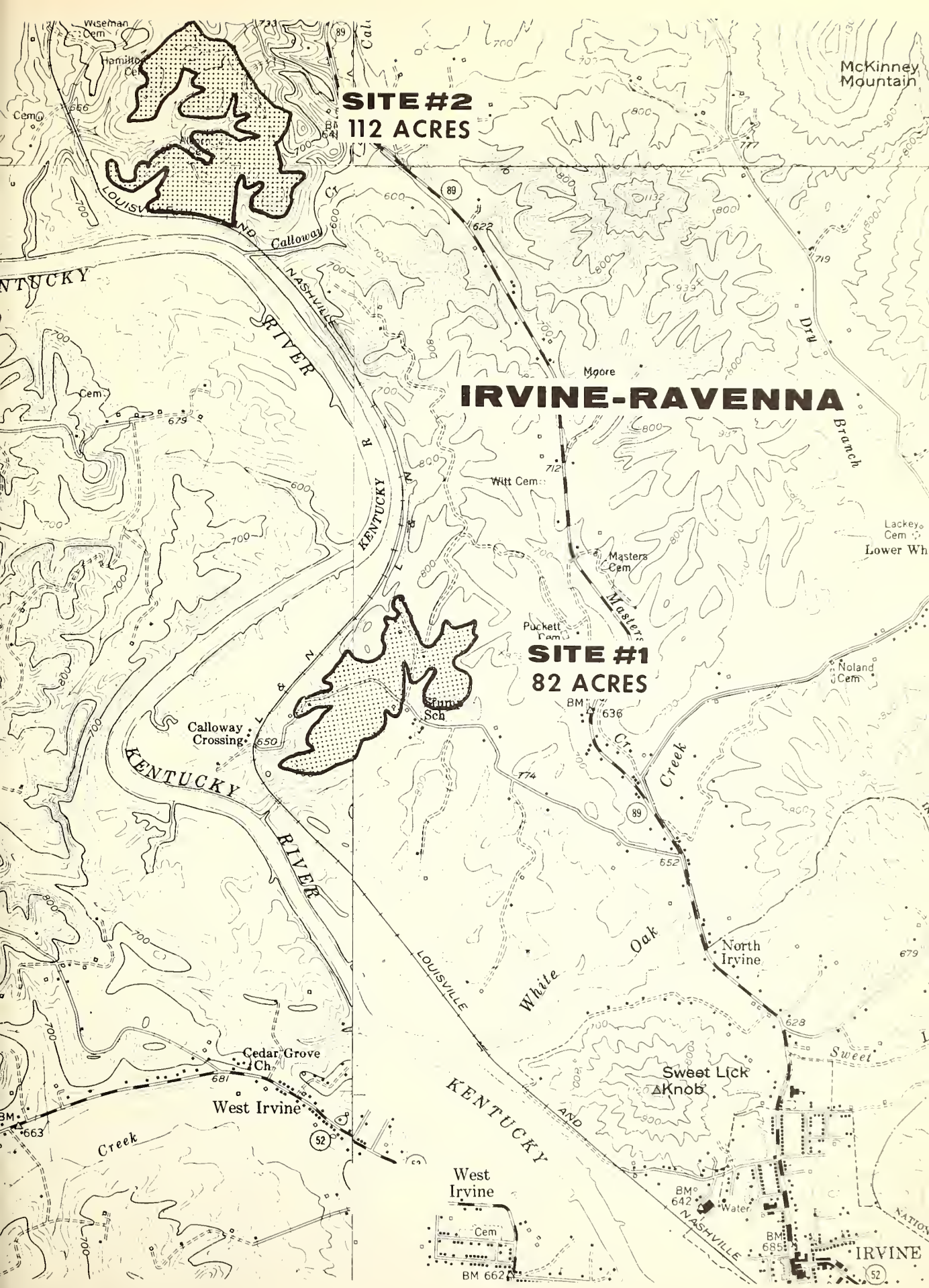
Site #1—Located two miles north (downstream) of Irvine, this site contains about 82 acres of rolling land which could be graded to make a suitable site. It is within 300 feet of the L. & N. Railroad. Access to the site at present is by 1¼ miles of unimproved road from State Route 89. Electricity and natural gas can be made available. Process water could be obtained from the Kentucky River. A water district, now being organized, will service the area.

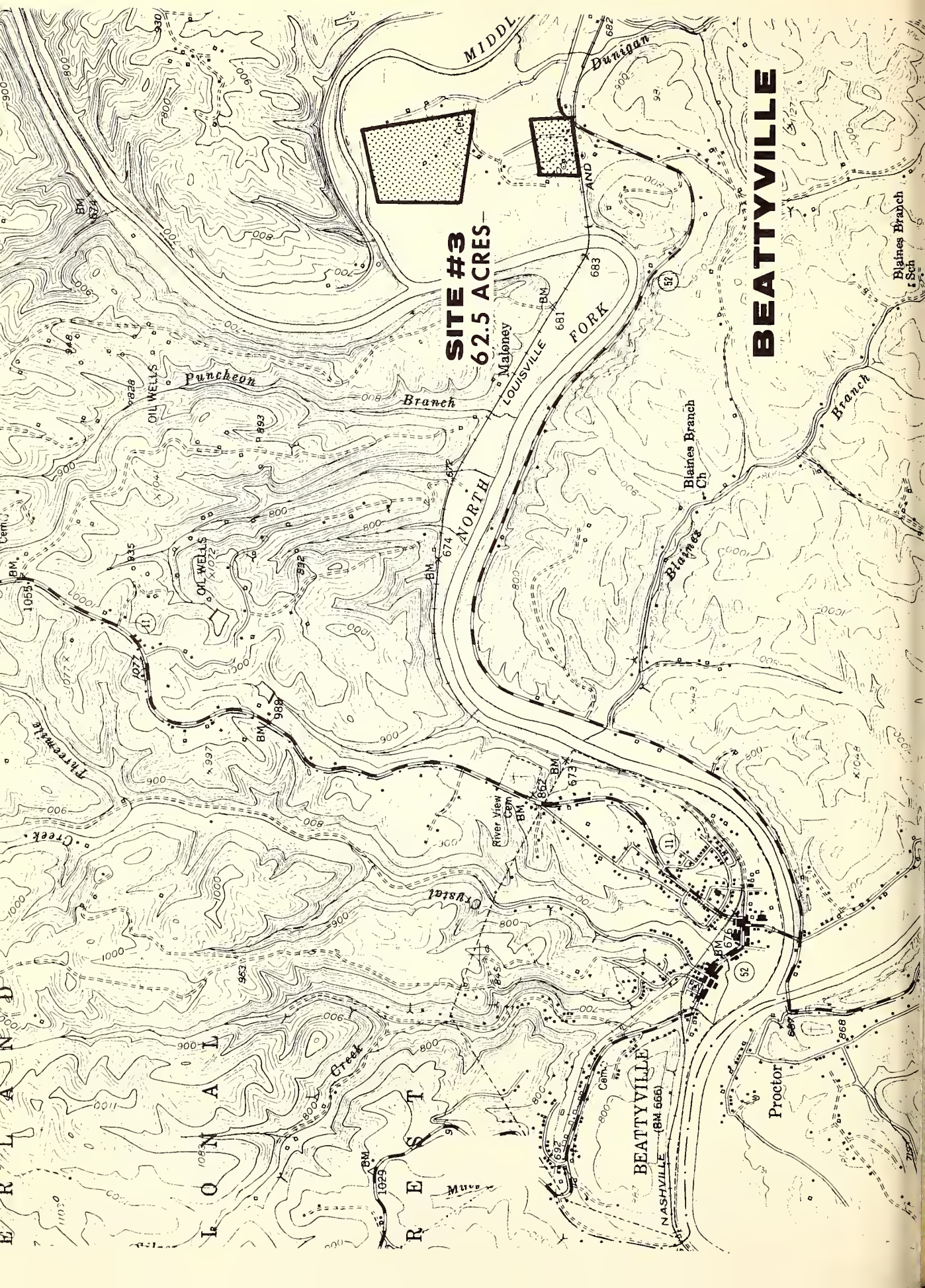
Site #2—This site, located four miles north of Irvine between the L. & N. Railroad and

SELECTED AREA LOCATIONS FOR THE PROCESSING COMPLEX

MAP V-1







SITE #3
62.5 ACRES

BEATTYVILLE

ERLAN

LOAN
Creek
RE
Mud

Crystal

NORTH
LOUISVILLE

Branch

Maloney

AND

MIDDLE

Dunigan

Blaine Branch

Sch

BEATTYVILLE
NASHVILLE (BM 666)

Proctor

Blaine Branch

State Route 89, contains about 112 acres of rolling land, a bit more level than Site #1, that could be graded to make suitable level areas. The railroad forms the boundary on one side. About $\frac{3}{4}$ of a mile of road could be built to permit access from State Route 89. Electricity and natural gas can be made available. Process water could be obtained from the Kentucky River. A water district, now being organized, will service the area.

Site #3—Located four miles up river from Beattyville, this site includes two separate pieces of property containing $13\frac{1}{2}$ and 49 acres respectively. The first is adjacent to State Highway 52 and the L. & N. Railroad; the second is 1000 feet to the north, accessible from a paved rural road. It is possible that the properties could be joined; both are relatively level. Electricity is available. Water can be pumped from the Kentucky River or obtained from shallow wells.

Area 2—Upper Cumberland River Valley

This area, centering on Williamsburg, occupies 5128 square miles within the confines of eastern Kentucky and contains 2,259,000 acres of forest land. The total forest resources in the area comprise 5.6 billion board feet of sawtimber and 9.4 million cords of cordwood. The wood raw material available annually for use by new industry is:

Saw timber.....	160,000 thousand board feet
Cordwood.....	829,990 cords

That portion of the procurement radius which extends into northern Tennessee has been disregarded as a source of raw material. Without doubt, a considerable quantity of saw logs and cordwood can be obtained from across the border.

The general area presently supports a moderate level of sawmilling and wood processing activity. This should serve to strengthen the log buying market and to make available a limited amount of experienced labor. Active support of a kind that would benefit the complex appears to be available from the major communities within the area.

Area Facilities

Williamsburg is served by the Knoxville-Atlanta Division of the Louisville and Nashville Railway. Rail transit times are $21\frac{1}{2}$ hours to Louisville or Cincinnati and $7\frac{1}{2}$

hours to Knoxville. U.S. Highway 25-W and State Route 92 pass through the town, and the proposed north to south Interstate Highway I-75 will pass just west of it. Highway distances are 184 miles to Louisville, 208 miles to Cincinnati, and 81 miles to Knoxville. The London Municipal Airport, 30 miles away, is served by Piedmont Airlines.

Barbourville is served by the Cumberland Valley Division of the Louisville and Nashville Railway. Rail transit times are $18\frac{1}{2}$ hours to Louisville or Cincinnati and 15 hours to Knoxville. U.S. Highway 25-E and several state routes serve the area. Highway distances are 200 miles to Louisville, 203 miles to Cincinnati, and 94 miles to Knoxville. Air transportation is available at London Municipal Airport, a distance of 26 miles.

Available Sites

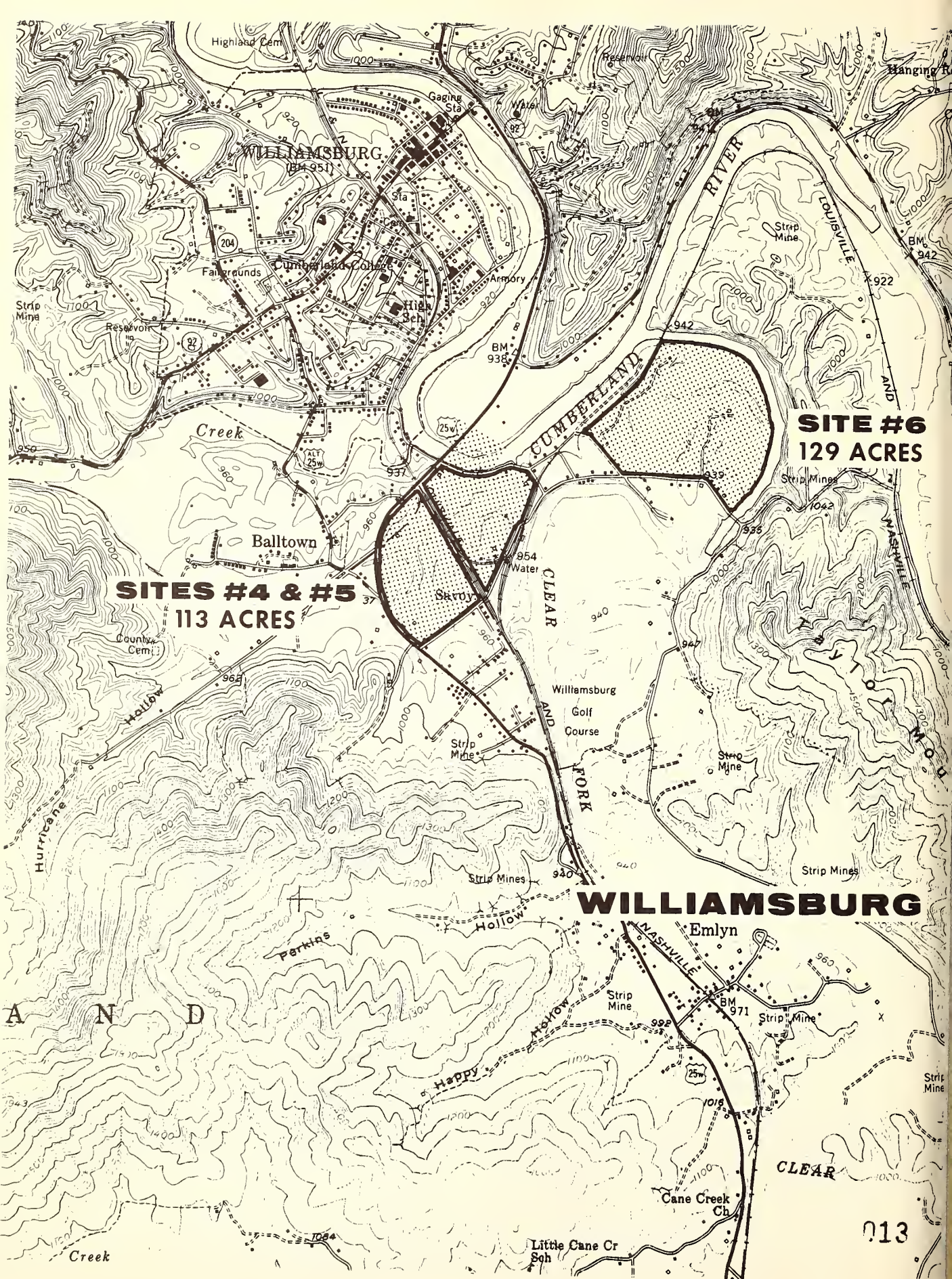
Five sites have been selected within this area; three are adjacent to Williamsburg, and two are adjacent to Barbourville.

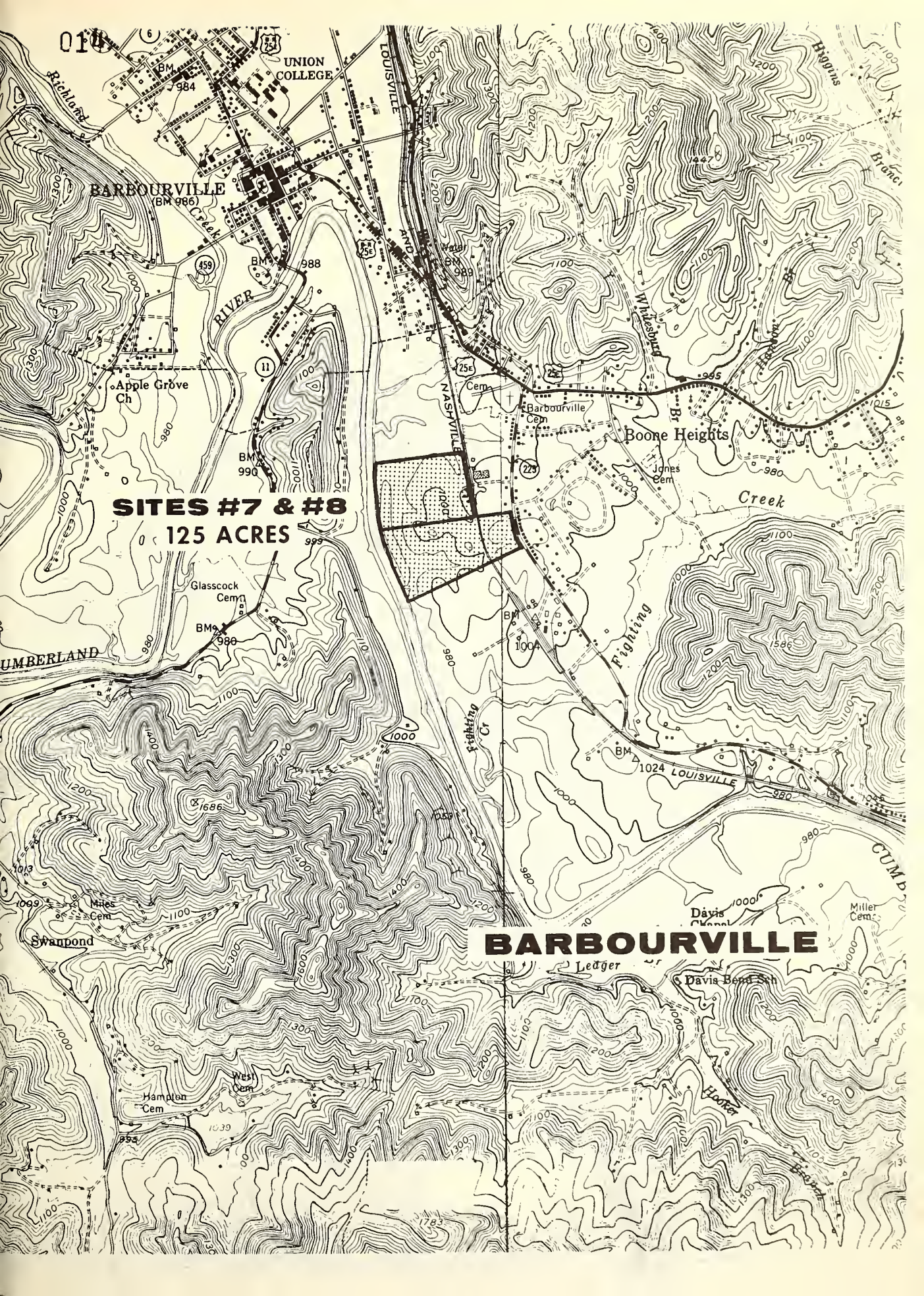
Site #4—This site, located a short distance from the southern limits of the city of Williamsburg, contains 61 acres and is adjacent to a line of the Louisville and Nashville Railway and U.S. Highway 25-W. The land is gently rolling. Electric power is supplied by the Kentucky Utilities Company. Natural gas is available from the City Gas Company of Williamsburg. City water and sewer lines are available to the site.

Site #5—Located to the south of the city limits of Williamsburg, the site is bound on two sides by lines of the Louisville and Nashville Railway and by U.S. Highway 25-W and a light-duty road. This site contains 52 acres of level to gently rolling ground. Electric power is supplied by the Kentucky Utilities Company. Natural gas is available from the City Gas Company of Williamsburg. City water and sewer lines are available to the site.

Site #6—Located approximately one-half mile to the southeast of the Williamsburg city limits, the site contains 129 acres and is bounded by a light-duty road, a line of the Louisville and Nashville Railway, and the Cumberland River. The ground is level to gently rolling. Electric power is supplied by the Kentucky Utilities Company. Natural gas is available from the City Gas Company. City water and sewer lines are available to the site.

Site #7—This site, located south of Barbour-





010

UNION COLLEGE

BARBOURVILLE

(BM 986)

RIVER

Apple Grove Ch

SITES #7 & #8
125 ACRES

Glasscock Cem

(BM 988)

CUMBERLAND

Swanpond

Hampton Cem

West Cem

BARBOURVILLE

Ledger

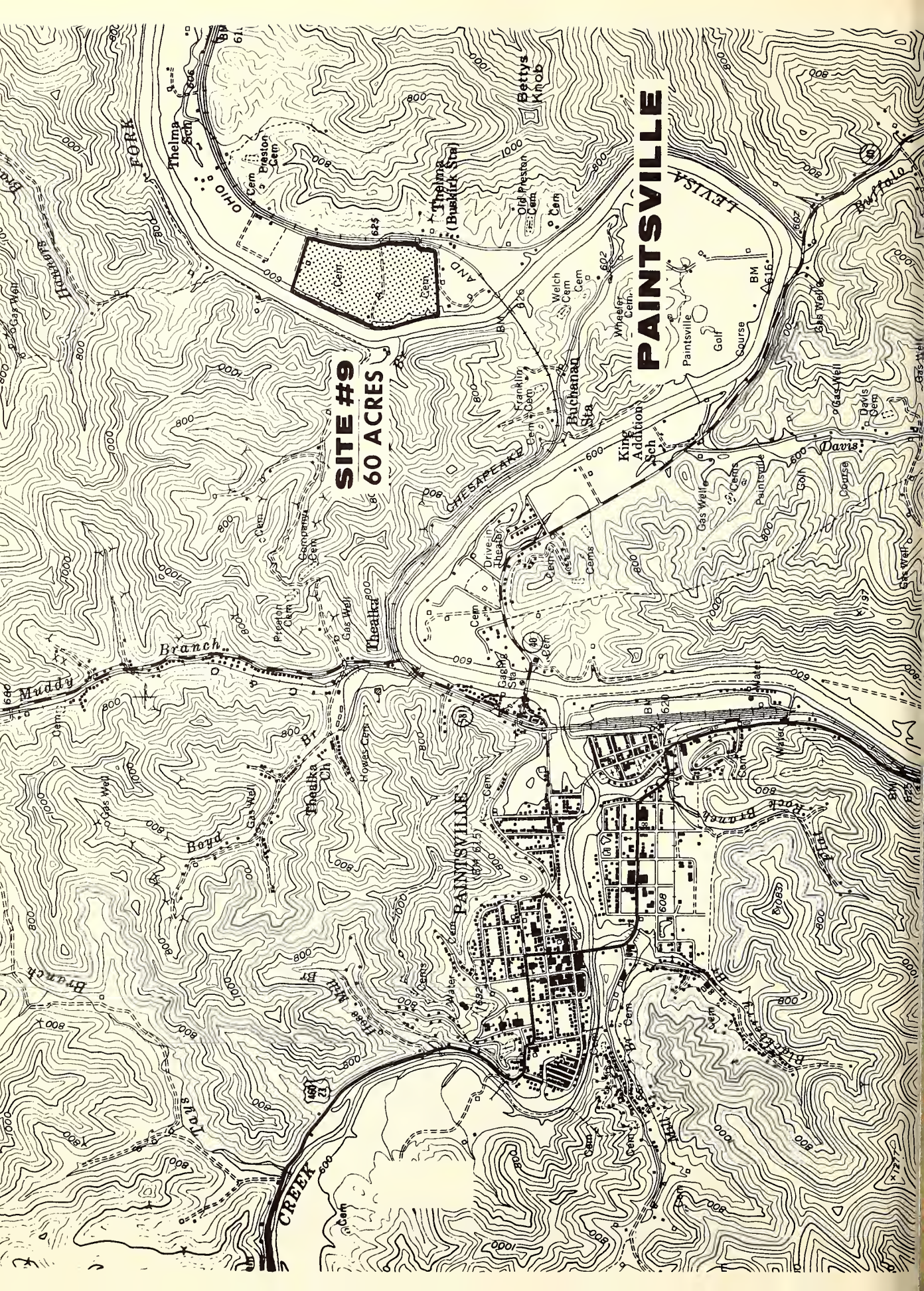
Davis Bend

Davis Channel

Miller Cem

Floater

SITE #9
60 ACRES



SITE #10
50 ACRES

50 ACRES

ville, between the railroad and the river, contains about 75 acres, of which about 50 are said to be flood-free. Water, gas, and electricity can be made available.

Site #8—This site adjoins Site #7, above. Adjacent to State Route 225, it runs to the river and is bisected by the railroad. The site contains about 50 acres; most of it is said to be above flood level. Water, gas and electricity can be made available.

Area 3—Big Sandy River Valley

This area, centering on Prestonsburg, occupies 5938 square miles within the confines of eastern Kentucky and contains 2,698,000 acres of forest land. The total forest resources in the area comprise 6.7 billion board feet of sawtimber and 11.2 million cords of cordwood. The wood raw material available annually for use by new industry is:

Saw timber.....	192,000 thousand board feet
Cordwood.....	991,267 cords

That portion of the procurement radius which extends into West Virginia has been disregarded as a source of raw material. Without doubt, at least limited quantities of saw logs and cordwood can be obtained from across the border.

The area is more distant from favorable marketing territory than either Area #1 or Area #2. Although the procurement area includes the greatest amount of forest acreage within Kentucky of the three areas that have been selected, much of the acreage is in large tracts that are considered unavailable as sources of saw logs. While the Big Sandy River is an excellent source of process water, the character of the processing activities being recommended does not impose a requirement for water. A pulp or wet-fiber processing activity, affiliated with but not part of the complex, could be situated on the river to good advantage.

Area Facilities

The entire valley is served by the Big Sandy Division of the Chesapeake & Ohio Railway Company. This Division connects

with the C. & O. main line at Ashland, to the north, and with the Clinchfield Railroad at Elkhorn City, to the south. Approximate rail transit times from Prestonsburg are 24 hours to either Cincinnati or Louisville and 48 hours to Knoxville, Tennessee.

Major highways now serve the area; portions of U.S. 23 are scheduled for improvement, and the East Kentucky Turnpike will be completed to Salyersville in 1964 and to the Big Sandy during 1967. Highway distances from Prestonsburg are 218 miles to Cincinnati, 219 miles to Louisville, and 246 miles to Knoxville, Tennessee. The Tri-State Airport, near Ashland, is 60 miles from Paintsville and 73 miles from Prestonsburg. It is served by Eastern, Piedmont, and Allegheny Airlines.

The area is substantially covered with distribution and transmission lines of the Kentucky Power Company. Natural gas, produced in the area, is available at most points.

Available Sites

Two sites have been selected within this area.

Site #9—Located east of Paintsville, it is owned by the Paintsville Development Council. It contains approximately 60 acres of flood-free level land. It is bounded on the east by the Chesapeake & Ohio Railway and Kentucky Route 270, and on the west by the Levisa Fork of the Big Sandy River. Process water can be obtained from Levisa Fork. All city utilities can be made available. The site may be a bit too far from the raw material source unless substantial quantities of timber can be obtained from Martin County to the east.

Site #10—Located north of Prestonsburg, the site lies about 2000 feet east of U.S. Highway 23 and is bounded on the south by the C. & O. Railway. It contains about 30 to 35 acres of level ground; and another 15 to 20 acres can be added by grading to the 760 foot contour. The site is owned by four individuals. Electricity, gas, and water can be made available.

Section VI

The Corporate Organization

Operating Structure

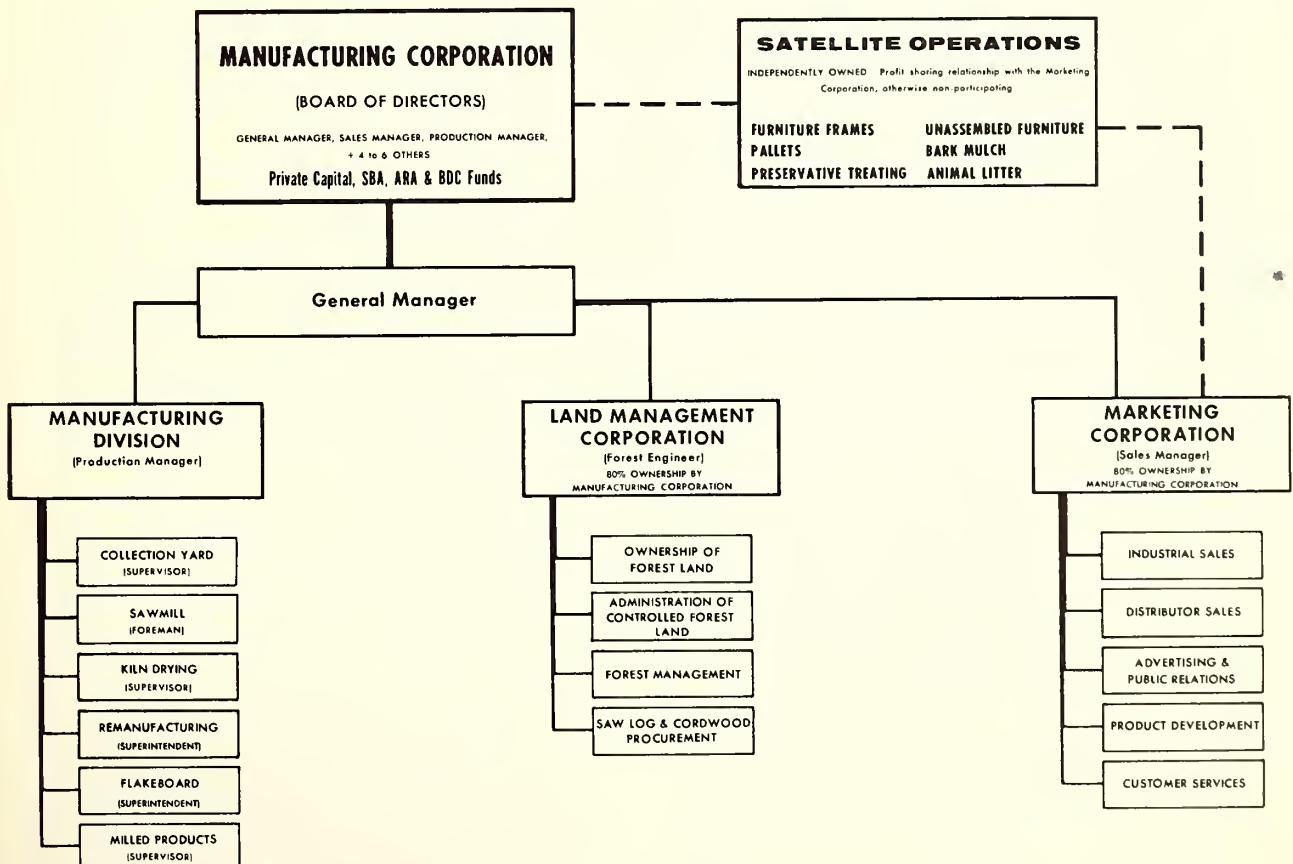
This section provides recommendations and a self-contained description of the corporate organization of the complex, presented in a manner that will enable it to serve as a guide to the preparation of related portions of an investment prospectus. The preparation of such a prospectus will appropriately be the responsibility of an attorney versed in Kentucky corporation law. For this reason, disclosures that are made are of a general nature and they refrain from involvement in the legal ramifications of establishing a busi-

ness instrument complying with Kentucky laws.

In creating a private organization, with ownership by the public at large, to operate a wood processing and marketing complex in eastern Kentucky, a corporate structure must obviously be used. The organization will require extensive financing and will have to be premised on a broader basis of participation than will be possible for any joint venture or partnership. The size and complexity of the overall operation detailed in this report largely precludes the carrying-on of a project by a single owner.

The corporate structure should not be over-complicated. However, the simplest struc-

DIAGRAM VI-1
THE MULTIPLE CORPORATION ORGANIZATION



ture—i.e., a single corporation controlling and owning all of the necessary functions—will not offer the maximum benefits to the parties involved. It is, therefore, recommended that the organization should be designed as the multiple-corporation operation as shown by Diagram VI-I on the opposite page. In making this recommendation, consideration has been given to the following factors:

1. Ownership, including the possibility of varying ownerships of operating subsidiaries.
2. The organizational structure which will assure the most tax advantage, considering: (a) income taxes on corporate earnings, (b) ability to retain earnings for reinvestment, (c) treatment of gains and losses, and (d) merger, consolidation, liquidation, and reorganization problems.
3. The location of facilities and personnel.

Principal and Subsidiary Corporation

It is suggested that there be created under Kentucky law a principal corporation which would own manufacturing facilities and would have ultimate responsibilities for the project. For convenience in this discussion this corporation will be referred to as the "manufacturing corporation." There should further be created, also under Kentucky law, a subsidiary corporation which would have the primary responsibility for sales, and a second subsidiary corporation which would have the responsibilities of real estate ownership and investment, extending to the development and management of forest land.

The manufacturing corporation would be owned by the investors as a group; and its board of directors should include the general manager of the corporation, the sales manager (who would also be an executive of the sales corporation), the production manager, representatives of the investors, and such other persons as would be deemed advisable to be included—up to a total of seven or nine.

The two subsidiaries, the sales corporation and the land management corporation (organized as a real estate corporation), could either be wholly owned by the parent, or partially owned with minority ownerships available to persons having special interest in the functions of a particular subsidiary. If partially owned, the parent should own at least eighty percent of each corporation, so that they can be considered as a consolidated operation for the purposes of pension and retirement plans, etc. Further, consolidated returns could be filed, if it were deemed

advisable, so that a deficit by one corporation—a likely matter in initial years—could be used to reduce the taxable income from another. Changes to separate tax returns, at appropriate times, could be made in the manner provided in the Internal Revenue Code.

The land management corporation would own and operate timber properties; would obtain from forest land owners an option to purchase stumpage; or would lease timber properties, together with the right to cut trees in an orderly manner. Alternative arrangements might involve long-term cutting, reforestation, and management agreements. As a further function, it would administer forest management projects so as to improve the quality and quantity of timber on both owned and optioned properties.

It is to be noted that the land management corporation, being a real estate corporation, will be entitled to special Federal tax benefits. These include a depletion allowance and authority to treat income from the sale of timber on property owned more than six months as a capital gain. Losses can be treated as ordinary income.

Multiple Corporation Operation

The principal reasons supporting the recommendations of a multiple-corporation operation are as follows:

1. The three corporations that have been suggested, each with its separate functions, can file separate tax returns. In each instance, corporate profits will have the benefit of up to \$25,000 income per year at the lower available tax bracket. At the present tax rate, a net saving of \$5500 a year on taxes of a single corporation will be effected for each additional corporation, assuming that the profits of each will be in excess of \$25,000 a year.
2. Each corporation will be able to accumulate separately the minimum accumulated earnings credit of \$100,000, and such additional amounts as are proper for its operation, without the necessity of having to dispose of the same as dividends.
3. This type of organization has the advantage of being able to provide for partial separate ownership and thus attract the investments of persons specially interested or qualified in portions of the activities of the complex—i.e., marketing or forest ownership and management.

4. The multiple corporations will permit merger, consolidation, partial or complete liquidation, reorganization or sale involving only one of the corporations.
5. The manufacturing company, being the controlling owner of the subsidiaries, will control the board of directors of each. Also, assuming investment by individuals with special interests and abilities, there will be available for each subsidiary's board additional persons especially familiar with its problems.

To the extent that the multiple corporation organization will have a total capital not in excess of \$1,000,000, of which not more than one-half is in shareholders' debt and the balance in stock ownership, with the remainder of its operations financed entirely from loans, it may qualify under Section 1244 of the Internal Revenue Code. If more than this amount were involved, this provision could not be available unless the subsidiaries were less than 80 percent owned, but it would be available to any independent organization meeting the financial limitation. Investors in such a corporation enjoy a tax advantage, in that losses sustained in the operation may be taken by the investor as a full loss against income, for income tax purposes. The purposes of this section of the Internal Revenue Code is to provide inducement for investing in new businesses, and it, therefore, seems peculiarly adapted to this situation, provided the organization can qualify financially.

Service Organizations

Trucking and similar functions can be carried on for the complex either by means of establishing contracts with independent service organizations able to do the work, providing these organizations financial support required for additional equipment, or by creating internal facilities either as departments of one of the three corporations or as additional corporations. The manufacturing corporation will have the legal ability to make funds available if necessary to give financial support to independent service organizations under contract. As an alternative, it could assist in obtaining funds through a small business investment corporation (SBIC) or similar agency. A long-term contract between the manufacturing corporation and an independent service organization could be used to support applications for loan assistance.

In the event it is elected that internal facilities are preferable to using the services of

independent organizations, it is pointed out that the creation of additional corporations is an easy technical problem and involves no great expense other than for initial incorporating costs. The important requirement is that each corporation have a truly separate function, or different ownerships, so as to prevent the group from being treated as a single, consolidated corporation.

Satellite Operations

It is contemplated that certain manufacturing activities at the complex will be carried on by independent operators. It is recommended that in dealing with such manufacturers, referred to as "satellite operation," a very close relationship should be developed. In return for making raw material available to the satellites at a reasonable price, for serving the satellites with a sales organization prepared to reach markets not otherwise available, and for extending assistance to the satellites in obtaining adequate financing for installation, modernization or expansion of manufacturing facilities, the manufacturing corporation should establish a strict contractual relationship with each of the satellites.

It is expected that the satellite operations will be able to obtain loans through local bank sources or from a small business investment corporation, these funds being funds which are available only in view of the favorable qualification derived from the contractual relationship with the manufacturing corporation. In order that this will not undermine the position of the manufacturing corporation, the contracts with the satellites must limit purchases of raw material elsewhere, provided it is supplied by the manufacturing corporations at reasonable agreed prices. And furthermore, the satellites should not be allowed, under the terms of their contracts, to dispose of products elsewhere provided the sales company of the complex is willing and able to handle them.

The agreement must also be fair to the satellites and, therefore, the manufacturing company must be bound to furnish them with raw material as needed on long-term contract. An escalator clause should provide for long-term adjustments of the "reasonable price" mentioned above. That is, some external standard should be applied that will properly reflect increases or decreases in price resulting from the state of the general economy or changes in production costs. A proper trade or governmental

index that is not influenced by the particular operation but which reflects the problems involved should be used for this purpose.

In further consideration of the sales relationship, the manufacturing organization should have a contractual obligation to dispose of a definite volume of products made by each satellite; for example, the full weekly production of a one-shift, five-day operation. In the event of failure by the sales company to dispose of agreed volume a satellite should be free to sell its products through other channels. It might be necessary, especially during the first years of the venture, to give the satellite protection in meeting loans if neither it nor the sales company could dispose of the amount of product that was contemplated. This would be particularly true if a satellite had undertaken material expense based upon a sales covenant.

Investment by Independent Manufacturers

It is anticipated that certain investors already engaged in wood processing activities may wish to set up additional manufacturing facilities in proximity to the complex and also to invest in the manufacturing corporation. In such instances, the complex should be protected from either improper competition or from having the profit of such an activity accrue only to the benefit of the investor rather than to the benefit of the manufacturing corporation. To assure such protection, it is recommended that a long-term contract be entered into by the parties for the supplying of a partially-manufactured product by the manufacturing corporation, on a basis that insures a profit to both corporations. The contract should require the investor's manufacturing operation to accept this product to the extent needed and not to purchase elsewhere so long as this product is offered in stipulated quantities and at a stipulated price, even if competing production should be offered at a lesser price. It is realized that this is a somewhat rigid requirement, but it seems to be justified in order to avoid future complications in the situation where an individual investor is operating on both sides of the picture. While the final details of these contracts probably cannot be agreed until operations actually start, they should be set forth in basic principle at the onset of the relationship. This will assure full disclosure to all potential investors that the

particular project is properly for the benefit of the manufacturing corporation, and is not a use of this corporation merely to assist the investor in making a profit in his own business.

Personnel Incentives

The manufacturing corporation will have to attract personnel both from within and without eastern Kentucky, but top executive personnel, especially, probably must be found outside the region. Appropriate inducements must be offered not only to such personnel but also to locally recruited personnel entering the organization who, it is to be hoped, will remain to develop into the future executive cadre.

One such inducement would be a properly designed vested plan of pension and profit sharing, for the purpose of insuring retirement income to its employees. A well designed plan should be available to all employees, from top management on down, excepting those unionized employees otherwise protected by means of union-negotiated plans or by wage rates negotiated in lieu of such a plan. The advantage to the employee of this type of provision for retirement income is that it provides supplemental income with no tax to be paid until the income is received at retirement age. Although it is then taxable, it presumably will be at reduced rates, as it will be in place of a higher salary. Insofar as the corporation is concerned, the company's payments from profits into the retirement fund are considered for tax purposes as expense at the time the contribution is made. Earnings of funds deposited in the plan during its period of operation are exempt from income tax. A capital gains tax is payable by the employee if he takes his share in a lump sum at the time of retirement, but he pays only income tax if his share is paid out periodically thereafter. A profit sharing plan of this type may exclude employees with less than two years of service, in order to assure that it will be available only to those showing some permanence with the corporation.

An extra inducement to top management personnel is the granting of a stock option which allows for the purchase of stock over a period of time and on terms which will be most satisfactory to participating personnel after the success of the corporation causes a rising market in its stock. These options are established at a price approximately equal to the current market price at the time the

option is granted and allow for purchase at any time or at specified times over an extended period of years. The employee is thus provided an appropriate inducement to work toward increasing business, resulting in a related increase in the value of the corporation's stock, since he can personally benefit by such an increase. This is especially valuable as a long-term incentive for an employee planning to stay with the corporation for many years.

Type of Securities

The stock structure best suited to the recommended organization would ordinarily be a simple common stock. However, if it

were desired to attract small investors who wish to obtain regular dividends commencing with the start of the operation and who have a greater interest in dividends than in capital appreciation, it would be well to include a preferred stock with the usual cumulative dividend features and callable at any time at a small premium. If desired, this stock could be made convertible, giving to the investor the right to obtain common stock if desired.

In creating the manufacturing corporation, especially, consideration should be given to the issuance of debt securities as well as equity securities, so that with proper attention to the restrictions of the Internal Revenue Code a portion of the investment will be a debt and can be repaid without being a taxable dividend to the investor.

Section VII

Meeting the Financial Requirements of the Complex

The magnitude of the wood products complex recommended in this report inevitably suggests problems to be faced in the field of financing, particularly in view of the relative scarcity of venture capital in eastern Kentucky. Furthermore, the fact that the several operations of the complex are inter-related and cannot operate efficiently as independent units means that the usual device of time-phased expansion of facilities cannot be applied. The purpose of this section is to examine some of the means available for proper financing of the complex.

Perhaps the first step in the analysis of the situation is to break down the total costs of site, site improvements, timber land, production facilities, and working capital into their component parts. Once this is done, discussion of the means available to finance particular requirements of the principal corporation of the complex becomes somewhat simpler. The costs, projected in another section of this report on page 82, are summarized here as follows:

Item	Principal Corporation	Satellite Corporations
Site and site improvements.....	\$135,000	
Timberlands.....	520,000	
Industrial buildings.....	801,300	
Installed equipment.....	2,560,600	\$557.50
Working capital.....	359,700	193.20
Totals.....	\$4,071,600	\$749.70

In this analysis, non-productive facilities (e.g., the corporate offices in Lexington and the space required for the marketing corporation) have been omitted. These activities can occupy leased quarters initially, at least, and can later arrange to have facilities constructed and leased to them on a long-term basis. No significant investment will be required by the corporation.

Once the nature of the overall costs has been analyzed, it will be necessary to determine how each component can be funded. For it is more or less obvious that no new company can expect to do the job itself in eastern Kentucky. Fortunately, however,

Kentucky has made numerous provisions for community and State contributions to the financial requirements of new industrial undertakings, thereby extending the effect of conventional lending institutions. Other governmental sources of industrial financing include the Area Redevelopment Administration, the Small Business Administration, the Rural Electrification Administration (in selected areas of the State), and the Community Facilities Administration of the Housing and Home Finance Agency—all activities of the Federal Government. The capability of each of these agencies to support various aspects of the necessary industrial financing

TABLE VII-I
ANALYSIS OF FINANCIAL SOURCES IN KENTUCKY

FINANCING SOURCES AND AGENCIES	ITEM OR FUNCTION FINANCED						
	Industrial Site Acquisition & Improvements	Timberlands	Industrial Buildings	Utilities & Services	(1) Electric Service	(2) Water	(3) Sewerage Machinery & Equip. Working Capital
1. Non-Government Sources							
Banks	x	x	x				x x
Insurance companies	x	x	x				
Ky. Business Development Corp.	x	x	x				x x
Public utility companies					x x x		
Savings and loan banks			x				
Small Business Investment Companies (SBIC)	x	x					x x
2. State Government Sources							
Local industrial development corporations	x	x					x
Kentucky Industrial Development Finance Authority	x	x					
Municipal general obligation bonds	x	x			x x		
Municipal industrial revenue bonds	x	x					x
3. Federal Government Sources							
Area Redevelopment Admin.							
(1) Industrial loans	x	x					x
(2) Public facility loans and grants						x x	
Housing and Home Finance Agency (CFA)					x x		
Public Health Service						x	
Rural Electrification Admin.					x		
Small Business Admin.							
(1) Loans to community development corporations	x	x					x
(2) Loans to small business	x	x					x x

are summarized in Table VII-I on page 116. The subsequent discussion illustrates the manner in which several of these agencies, private and governmental, together with available venture capital, could support the financing required for the complex.

Financing the Principal Corporation

The successful launching of the corporation to operate the proposed wood products complex depends basically upon the ability to mobilize private venture capital, particularly in eastern Kentucky. The organizers of the corporation, however, have some basic tasks to perform before a public issue of stock may be made.

The founders, who will be a group of community leaders and businessmen seriously interested in the project and who will serve initially without pay, must first establish the legal existence of the corporation and contribute appropriate funds in exchange for common stock. To begin with, a minimum of about \$50,000 will be required; common stock could be issued at a nominal par value of \$1 per share, for example. Subsequent to the legal establishment of the corporation, the founders will embark upon a preparatory program roughly as follows: (1) a project engineer will be engaged to implement final plans for the complex, selecting a site and adjusting the broad outlines of the project to the local circumstances; (2) the founders will endeavor to secure the support of the local community development corporations responsible for tentatively identified sites and will confer with community leaders, bankers, Chamber of Commerce groups, and others whose support will be required; (3) the founders will locate and secure options to buy up to 26,000 acres of suitable timberland; and (4) when discussions have reached the proper stage, the corporation will issue a detailed prospectus—based on the present report and including information relative to the final site, purchase options, and other details—offering stock of the corporation to the public.

The size of the public stock offering should total about \$1.5 million; it is suggested that the initial offering be made at par value in minimum blocks of 100 shares of common stock. This method of financing should attract support from a relatively large number of private investors with moderate sav-

ings—mainly from professional groups. Sizable investments should, of course, be solicited from prominent citizens of eastern Kentucky and from within the wood products industry, including proprietors of future satellite operations and consumers of the products to be manufactured by the complex. Unless the issue is registered with the Securities and Exchange Commission, however, stock sales must be limited to Kentucky residents.

Assuming the success of the stock issue, the corporation will have cash assets of about \$1.5 million and broad-based support throughout the State. It will then be ready to consummate the plan of the complex. The following outline of procedures for financing the activities of the complex is intended to be illustrative only; details will depend on local conditions, money markets, and other factors not amenable to discussion at this point.

Site Acquisition, Site Improvement, Buildings

Most suitable industrial sites in eastern Kentucky are already owned by the various community development corporations in the region and can be leased to an appropriate industrial undertaking. If, however, the site needed for the complex (54 acres) is not held by such a group, tested procedures in Kentucky make it a relatively easy matter for the group to acquire it. Providing the community development corporation can secure guarantees amounting to 50 percent of the purchase price (for a tract of 50 acres or more), from within the community or from institutional lenders or both, it can apply to the Kentucky Industrial Development Finance Authority (KIDFA) for the balance. Funds secured from KIDFA can be used for site improvements, installation of necessary utilities and construction of access roads, and for industrial buildings. KIDFA policies require that adequate conventional loans are not available from banks prior to the application from a community development corporation.

Several alternative means of financing sites and site improvements are available to local groups in eastern Kentucky, short of seeking the support of the Area Redevelopment Administration. These include (1) the issuance of municipal industrial revenue bonds (25 years, 6 percent) for land, buildings, and equipment for industrial enterprises; (2) municipal general obligation bonds covering land and buildings (rarely used); (3) water and sewerage development under

municipal bonds, for extension of services to industrial sites; and (4) State assistance to county highway development, especially for access roads.

Depending upon the circumstances, public utility companies may agree to construct electrical facilities suitable to the industrial undertaking, providing future revenues warrant the expense. Area railroads, similarly, may construct industrial spurs if the site is not already on a railroad, providing sufficient freight revenues may be expected in the future.

Special sources of financing available from U.S. Government agencies include low cost ARA industrial loans (up to 65 percent of the cost of land and buildings and equipment) under feasible circumstances; ARA public facility loans and grants to communities (for extension of water and sewerage facilities to new industry); Small Business Administration loans to community development corporations (land, buildings, and equipment, up to \$250,000, provided 20 percent of the cost is obtained locally). Expanded or additional water and sewerage installations required to service the site can also be financed by loans from the Community Facilities Administration, HHFA, or—in some cases—by grants from the Public Health Administration. The construction of electrical facilities for rural industries in some areas of eastern Kentucky can be accomplished with the aid of loans from the Rural Electrification Administration.

In view of the fact that industrial sites are already available on lease from community development corporations, the emphasis to be expected at the community level will be on site development and the provision of buildings. Loans from KIDFA and other sources should be readily available for site development. Municipal industrial revenue bonds perhaps offer the best means to finance the cost of buildings (about \$801,300), to be leased to the complex.

Whatever means, or combination of means, used by the local development corporation, the provision of an improved site with adequate buildings is a relatively easy task and one which will require no permanent investment by the corporation.

Acquisition of Timberlands

The plan for the operations of the complex provides for outright purchase of about 26,000 acres of timberland by the land management corporation, at an estimated cost of \$520,000. There are no statutory provisions that enable community development corpora-

tions, KIDFA, or other development assistance agencies to purchase timberland. It is conceivable, however, that the laws could be interpreted in such a way as to class such land as industrial property. Nevertheless, it should be a reasonably simple matter to arrange for purchase of the required land through conventional lending agencies. In such a case, the corporation would expect to pay 25 percent to 40 percent of the purchase price of the property under option (\$130,000 to \$208,000) and to obtain a mortgage for the balance. Considering the extent of the mortgage, it may be necessary for several area banks to pool resources as a consortium to fund this undertaking. Repayment of the mortgage should be based on corporate earnings, with a moratorium on repayment of principal for the first five years. On the other hand, provisions should be made for prepayment of the mortgage by the corporation when possible.

The arrangement suggested here will conserve the cash assets of the corporation, which will be required to purchase machinery.

Installed Machinery and Equipment

The major direct investment of the corporation will be for the machinery and equipment to be installed at the complex site. Assuming the successful issue of \$1.5 million of capital stock, the corporation will be able to pay only about 40 percent of the total projected cost of equipment required. Several approaches to financing the balance are available:

1. Outright purchase of some equipment, plus the negotiation of long-term credit with equipment suppliers for the balance.
2. Outright purchase of some equipment and lease of other equipment from industrial leasing organizations.
3. Reliance on municipal industrial revenue bonds for a portion of the equipment, perhaps for a complete major installation such as the flakeboard plant. This alternative, however, requires the corporation to lease the equipment from the community, a situation to be avoided if possible.
4. Private placement of capital stock and/or debentures with conventional lending agencies to finance the balance of the equipment cost (\$1.5 million).
5. Private placement of capital stock and/or debentures with the Business Development Corporation as in (4) above, or for any portion not accepted by conventional lending agencies.

- 6. ARA industrial loans, preferably for a major installation such as the particle board plant; this type of financing is rare with ARA, however.
- 7. Small Business Administration loan, as in (6) above.

Working Capital

Initially, working capital will be available to the corporation in the form of the proceeds from the public sale of capital stock. Additional short-term loans for working capital, as required, can be negotiated with banks in Kentucky, with the Business Development Corporation, and—under certain circumstances—with the Small Business Administration. The availability of short-term credits from banks in the region will be particularly important, and procedures for utilization of such credits should be established as early as possible.

Summary of Financing for Principal Corporation

Working from the original assumption that the corporation will be able to sell about \$1.5 million in capital stock through a public offering within the State, the corporation will be able to commence operations with the following financial condition:

Item	Cost	Disposition of Corporate Assets
Improved industrial site.	\$135,000	Financed by community and leased by corporation.
Industrial buildings.	\$810,300	Financed by municipal industrial revenue bonds plus KIDFA and/or ARA loans; leased to corporation.
Timberlands...	\$520,000	Corporation paid \$208,000 in cash (maximum), secured a mortgage on balance (20 years at 6%) for \$312,000.
Machinery and equipment.	\$2,560,000	Corporation bought equipment for \$1.0 million; secured loans or credits for balance (or leased equipment).

Working capital. \$359,700 Corporation has \$292,000 available for startup costs, wages and salaries, operating expenses, raw materials, and debt servicing; balance on revolving line of credit with local banks or BDC.

Financing Satellite Operations

Since the satellite operations will, in most cases, be tenants of the principal corporations, the primary problems faced by them will be to secure adequate financing for equipment and working capital. In no case does the requirement for capital exceed \$225,000; and in most cases the requirement is in the range of \$150,000 or less. Assuming that most proprietors of satellite operations will have some experience in their fields of manufacturing, they will already have available some equipment and liquid assets and will have established credit with local banks and suppliers. Additional capital required will be obtained from within the local community, by public sale of securities, and/or by recourse to such agencies as the Business Development Corporation. The latter agency is empowered both to make loans and to take equity positions in new or expanded industry in Kentucky. In addition, the smaller operations will have more readily available to them SBA loans—assuming some previous product experience—and financing from Small Business Investment Corporations. If the proposed commercial or industrial facility is to be located in an ARA designated area of critical unemployment, it is possible to obtain long-term financial assistance from ARA for the acquisition of capital assets (not working capital) contingent upon other circumstances being favorable. However, of the total financing such assistance requires at least: (1) 10 percent furnished by a local development company (acceptable to ARA); (2) five percent from the applicant; and (3) 20 percent from private fund sources.

Section VIII

Marketing Potentials for Selected Products

It is apparent that the volume of sales projected for the wood products complex depends as much upon realistic appraisals of markets as upon aggressive and imaginative salesmanship. This section presents summary market analyses for each of the principal products recommended for the complex. These summaries were developed during the course of this project and are believed to be reliable within the limits of the data available.

Market data used in these summaries derived from a variety of sources, including manufacturers of wood products and furniture, consumers of wood products, trade association, and several agencies of the Federal Government and of the Kentucky State government. Data accumulated from these sources were analyzed and projected against data available in such published sources as the *1958 Census of Manufacturing*, industry reports, and the annual *Outlook for Manufacturing*. In several instances, notably the market summaries for preservative treated products, litter, mulch, wood chips, paneling, and pallets, no published data were available and the discussions and projections are based largely on original research. Appropriate credit is due Mr. Harrod Newland, Kentucky Department of Commerce, for his initiative in conducting a survey of the market for preservative treated posts and railing in Kentucky in connection with this report.

Despite the inherent limitations of the summaries, they serve to confirm the size of the existing or potential markets for several classes of wood products and to support the magnitude of production envisaged for the several operating plants included in the recommended wood processing complex. A more precise study of market potentials for many of these products is available in the form of a comprehensive report, *Wood Used in Manufacturing*, compiled by the U.S. Forest Service. Two related conclusions of significance appear as a result of the market summaries presented below. First, eastern Kentucky is well-situated to supply raw materials and semi-finished wood products (dimension, core stock, furniture frames) to a major part of

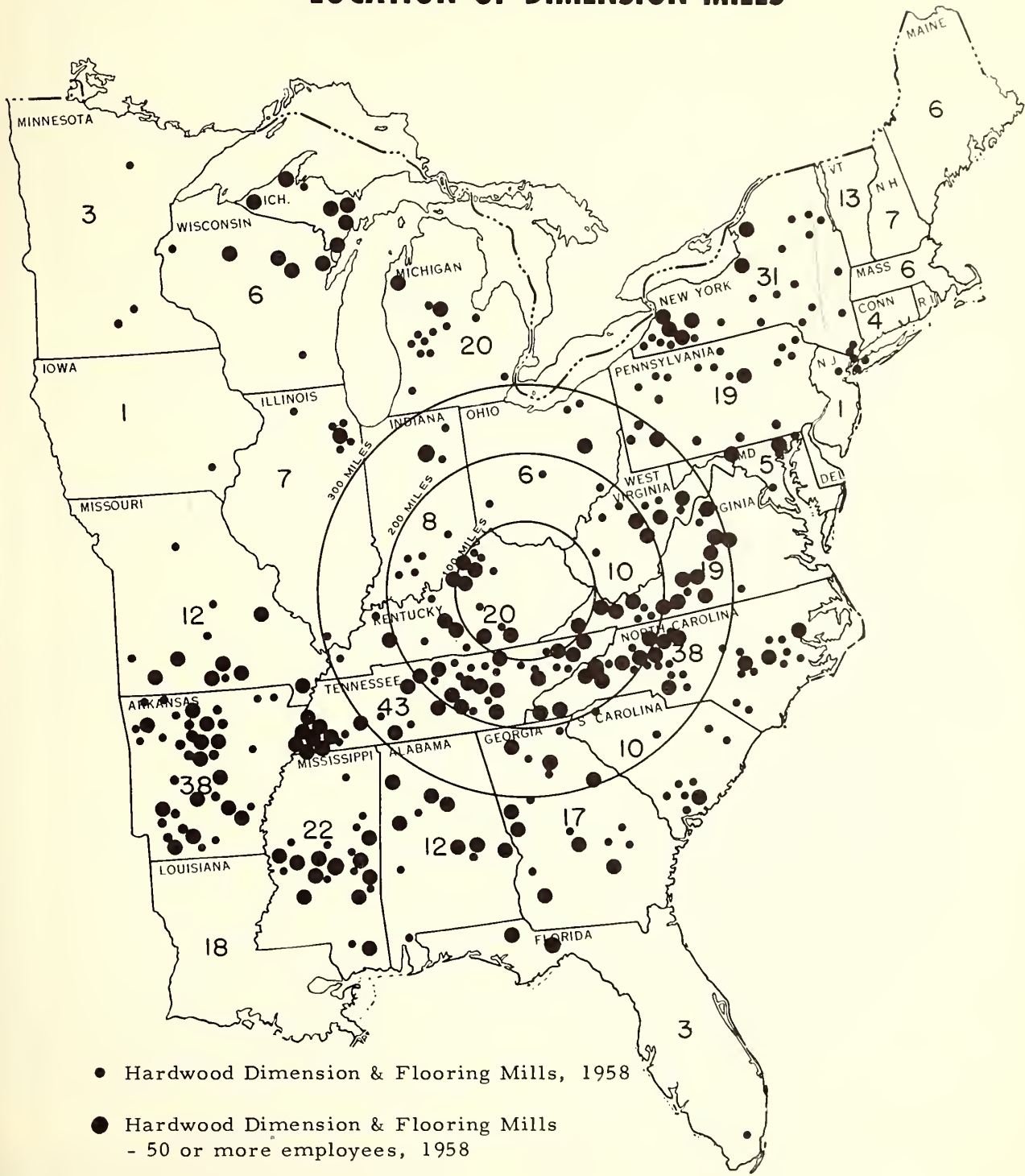
the important U.S. furniture industry, and at competitive prices. Second, markets for these and other eastern Kentucky wood products should not be artificially restricted to nearby furniture centers in border States. Although a nominal market area, with a radius of 300 miles from a central location in eastern Kentucky, has been used in this report, the rapidly improving transportation network—in particular, the Eastern Kentucky Turnpike and the Federal interstate highway system—provides increasingly easy access to more distant industrial markets: Chicago, Detroit, New York, Philadelphia, Baltimore, St. Louis, and even Los Angeles, for example.

Finally, it will be the continuing function of the marketing corporation of the complex to test and adjust the projections presented in this report. The furniture industry, probably the most important single customer of the complex, will certainly continue to grow in the future in rough proportion to the growth of the population. But steadily increasing wages in the major furniture manufacturing areas will force the adoption more and more of semi-assembly line techniques, with increased demand for dimension, prefabricated parts, semi-finished assemblies, and prefabricated frames. The sales and technical assistance program outlined earlier will undoubtedly turn up requirements for products other than those included in this section—and in industries other than furniture manufacturing. Market analysis, after all, can alert a competent sales organization to profitable opportunities; but it cannot replace an aggressive and imaginative sales force.

Dimension and Laminates

Dimension stock consists of wood machined to the specifications of an ultimate manufacturer. In a broad sense, dimension stock comprises the interchangeable parts that permit some mass production techniques to be used in the wood products industry. Included in dimension stock are edge glued panels and simple laminated stock. Dimension stock is widely used by the furniture

LOCATION OF DIMENSION MILLS



industry but is also used in the production of other wood end items, including ladders, stair treads, picture frames, boats, household items (screens, room dividers, cutting boards, trays, etc.), and industrial items (wooden bakery ware, cutting boards, shelving, counters, etc.). This section does not include a consideration of laminated structural members, known as "glue-lam."

Rough dimension stock consists essentially of blanks for items that will later be manufactured in a using plant: chair arm blanks, for example. Or, as another example, rough dimension can be edge-glued panels of the approximate size for drawer sides; these panels are cut to exact size, surfaced, and machined by the using plant or by an intermediate processor. The production of rough dimension stock requires a minimum number of skilled personnel; uses conventional saws, planers, and gluing devices; and adapts itself to mass production techniques, ease of handling, and convenient packaging for shipment.

Finished dimension stock takes the basic blanks one step further and requires the use of woodworking machinery to shape, turn, sand, route, groove, slot, joint, bore, etc. Some additional skills are required to insure high quality production, though mass production techniques can be utilized, and greater attention must be given to packaging and shipment of finished dimension.

The increasing acceptance and use of dimension by the furniture industry, in particular, is a result of several interrelated factors including the high cost of labor in many of the furniture producing centers of the country, shortages of suitable hardwoods, and production economies. Although many of the dimension mills are located in or near furniture producing areas in the Southeast, as shown on the map of hardwood dimension and flooring mills, comparison with the map of wood furniture plants and that of upholstered furniture plants shows that there is no necessary correlation between the location of dimension mills and furniture plants. Rather, dimension mills tend to locate near the source of raw material. The heavy concentration of furniture mills in the Northeastern States, southern Indiana, northern Illinois, eastern Wisconsin, and southern Michigan—where raw materials must often be imported and where wage rates are relatively high—are obviously dependent to a large extent on the production of dimension mills in the Southeastern States. The market for dimension stock, therefore, extends far beyond the primary production centers.

Many existing mills, in fact, have established national markets for their products.

Additional dimension mills in eastern Kentucky can expect to tap furniture markets in Kentucky, Indiana, Ohio, Virginia, North Carolina, and Tennessee on very favorable terms. In particular, the furniture industry in Indiana and Ohio should be unusually available to a dimension mill in eastern Kentucky. Most existing plants in these areas must now draw on plants located farther away (and with higher labor cost). Similarly, eastern Kentucky is favorably located as a source of dimension stock for the furniture industry in northeastern Illinois (Chicago area), southeastern Wisconsin (Milwaukee-Sheboygan areas), southern Michigan (Grand Rapids and Detroit areas), and the large concentration of plants in or near New York City, Philadelphia, and Baltimore.

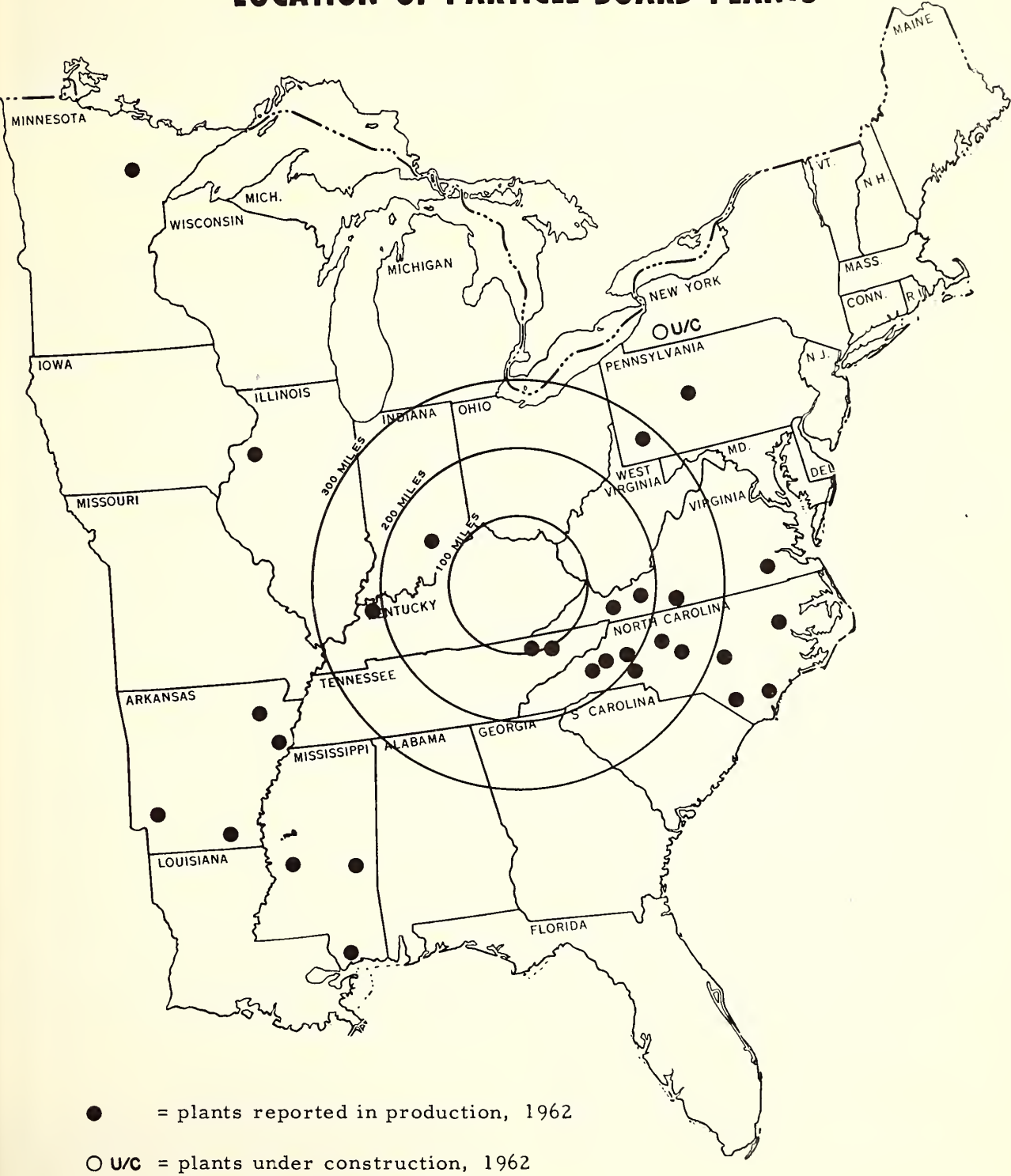
While the above discussion has emphasized the use of dimension stock to the furniture industry, any plant established in eastern Kentucky will also be able to develop a market for dimension within the nearby truck and trailer body industry, the electrical appliance industry (shaped wooden parts for packing and crating), the boat building industry, and others. Aggressive market development is, of course, an essential factor in this field, as it is in any product line recommended here.

The potential for a profitable industry is particularly good with respect to dimension stock. The discussion in the preceding sections of the report has already indicated that high grade lumber is not a necessary raw material in the production of dimension. Rather, lower grade lumber can be upgraded by selectively cutting rough dimension from it, thereby removing knots, fire scars, and diseased spots. This rough dimension, all of which will be essentially prime raw material, has a value far in excess of the boards from which it was cut. While prices vary widely, because of the range of materials and operations involved in manufacturing dimension stock, a recent average price is about \$240/M b.f. Since freight charges play a large roll in determining the profitability of dimension, eastern Kentucky's favorable location near the Nation's major furniture centers is a prime factor in recommending the production of dimension stock.

Demand

The demand for dimension stock has increased rapidly as more and more manu-

LOCATION OF PARTICLE BOARD PLANTS



facturers close down their in-plant wood-working shops in the interests of economy of operations. In 1958, sales of dimension stock and laminates to all segments of industry were about 485 million board feet. Considering the fact that this was a slow year for industry, and that many of the using industries have since recovered and/or expanded, current demand for dimension and laminates should be about 560-600 million board feet.

The distribution of shipments of dimension stock and laminates in 1958 was as follows:

PRODUCT	1958		1954	
	QUANTITY (MBF)	VALUE (\$1000)	QUANTITY (MBF)	VALUE (\$1000)
Furniture Dimension, including glued laminates:				
Green or dried, rough or surfaced	134, 134	30, 503	219, 539	37, 171
Semifabricated	41, 704*	6, 243		
Other Industrial Dimension	85, 702*	15, 118	117, 521*	19, 619
Semifabricated Industrial Parts	NA	2, 990	NA	NA
Completely Fabricated Indus- trial Parts:				
Furniture parts except frames	NA	30, 936	NA	29, 934
Vehicle stock	NA	2, 917	NA	4, 362
Other hardwood parts	NA	6, 757	NA	NA
Hardwood Dimension, not specified	NA	7, 531	NA	NA
TOTAL	485, 400*	102, 895	--	--

Source: 1958 Census of Manufacturers, "Logging Camps, Sawmills, and Planing Mills," MC58(2)-24A, U. S. Department of Commerce, Washington, D. C.

* Estimated Value

About 50 percent of all dimension stock is consumed by the furniture industry, or an estimated 280-300 million board feet in 1962. About 50 percent of all non-upholstered household furniture and 37 percent of all upholstered furniture, by value, is produced within a 300 mile radius of eastern Kentucky (see maps of furniture plants, pages 123 and 132). If the North Central and Northeastern furniture producing areas outside this radius are included as possible markets, a dimension plant located in eastern Kentucky could serve an estimated 75 percent of the household furniture industry. Additional sales, of course, will be developed among the nearby office furniture producers, manufacturers of mattresses and box springs, and miscellaneous furniture plants.

Industrial uses for dimension stock—agricultural equipment, sporting goods, railroad car and motor vehicle parts, gun-stocks, brushes, ladders, and household goods, etc.—should provide a large, attractive market for a dimension plant located in eastern Kentucky. There appears to be no reason why an efficiently managed dimension mill in eastern Kentucky cannot easily produce and sell 4-5 million board feet of rough and finished dimension a year, for a gross income of \$500,000 to \$1,000,000.

Laminated Solid Wood Core Stock

Laminated core stock made from solid wood is widely used in the quality furniture industry as a base material for the application of veneers, plastic overlays, etc. The product competes with plywood and particle board, extensively used in the furniture industry for the same purposes, but many manufacturers of quality furniture prefer to use lumber core stock.

Laminated core is manufactured by edge-gluing narrow strips of hardwood into modular panels; modern production techniques include the use of synthetic resins and electronic bonding presses. The soft hardwoods—particularly yellow poplar—are best suited to its production. Laminated core stock is notably stable and is well suited to the manufacture of case goods, tables, office furniture, and other furniture requiring long, wide unsupported panels. From the standpoint of the core stock producer, modern production techniques permit him to make efficient use of lower grade lumber—in a manner similar to the techniques discussed above for dimension stock—for a substantial monetary return. High grade laminated core stock markets at prices averaging about \$.30 per square foot.

While laminated core stock is more expensive than particle board or plywood, industry spokesmen indicate a distinct preference for its use in high quality furniture, particularly in North Carolina. As shown by the map of non-upholstered wood furniture plants, page 129, eastern Kentucky is well-situated to serve this market.

Demand

The annual demand for laminated core stock remains fairly steady at about 45-50 million square feet. The rapidly increasing

production of particleboard in the Southeastern furniture producing area undoubtedly will act to prevent any large increases in the use of laminated core stock, but superior qualities of laminated core stock will serve to keep demand reasonably steady for many years to come. Because laminated core stock is used most extensively by manufacturers of quality furniture, it is not likely that the flakeboard operation of the eastern Kentucky wood processing complex will compete for more than a small portion of the existing market for this product.

Flakeboard

Flakeboard is an engineered product consisting of wood flakes, of a controlled moisture content and size, bonded together with a synthetic resin or other added binder into panel form under controlled heat and pressure. Flakeboard is a member of the generic product group called particleboard. Particleboard, including flakeboard, is used in increasing quantities for veneer overlaid core material; furniture tops, end panels, and drawer fronts; underlayment; decorative paneling; cabinet and counter cores; veneer overlay; paper plastic overlay; and interior partitioning. During 1962, greater use of particleboard by the construction industry was forecast, based upon the development of an exterior phenolic board. The wood particleboard industry continues to be the fastest growing segment of the wood products industry, with production conservatively estimated at 354 million square feet ($\frac{3}{4}$ in. basis) from 47 plants in 1962. This represents an increase of 11 percent over 1961 production and annual growth in excess of 10 percent since 1954. Industry estimates for 1970 provide for production of 800 million square feet from 75 plants. See map on page 123 for location of production facilities, 1962.

The extensive use of flakeboard and particleboards of various types by the furniture industry has resulted in the establishment of "captive plants" designed essentially to produce for internal corporate consumption. Many of these plants are located in North Carolina. The single operating plant in Kentucky (at Henderson) is owned by Jaspar-American Company, a furniture manufacturer. Lane, Kroehler, and Storkline are other large furniture manufacturers operating captive plants.

As a partial result of this situation, a large

but undetermined portion of the total production of particleboards of all types in the Eastern United States has not been available commercially. A 1958 survey of the potential for particleboard production in Georgia showed that about 50 percent of all material sold in that State originated from west coast plants. Assuming a similar situation in other nearby States, it appears that a sizable market exists for particleboard produced regionally, since the cost factor of freight rates from the west coast will be eliminated (about \$38-\$40 per thousand square feet). The validity of this conclusion is confirmed by the fact that three new Southeastern plants entered the market during 1961-62, adding about 110 million square feet capacity for mat-formed particleboard. A fourth plant with a design capacity of 23 million square feet is under construction in New York State.

As shown on the map, there are two plants within a 100-mile radius of eastern Kentucky, one of which is a captive producer. Seven additional plants are located within a 100-200 mile radius of eastern Kentucky, five of which are captive plants. Five more plants are located within a radius of 200-300 miles from eastern Kentucky, including at least three captive plants. The rated capacity of plants located in Kentucky and surrounding States in 1958 and 1962, was as follows:

STATE	NO. PLANTS		PRODUCTION - Million Square Feet		
	1958	1961 ^{1/}	Estimated Capacity 1958	Rated Capacity 1962 ^{2/}	Reported Output 1962 ^{2/}
Kentucky	1	1*	2.3	10.5	5.0
Virginia	3	4#	35.0	105.0	49.7
Tennessee	2	2*	8.0	9.8	2.5
North Carolina	14	10@	118.0	111.8	57.4
Indiana	1	1	5.0	10.0	N. A.
Illinois	1	1	18.0	30.0	26.4
	22	19	186.3	277.1	141.0+

^{1/} Source: Current Industrial Reports, BDSAF-582 (61)-1, June 5, 1962, U. S. Department of Commerce.

^{2/} Source: Forest Industries, July 1962 (1962 Directory of Board Producers).

* - One plant produces extruded board only.

- Includes two plants producing extruded board.

@ - Includes seven plants producing extruded board.

The trend toward the larger independent producer is shown in the above table; despite a net loss of three plants between 1958 and 1961, production capacity more than doubled. Most, if not all, the newer capacity is designed for the production of mat-formed particleboard suited to several markets.

The effects of changing technology and market conditions on producers as a whole is suggested by a listing of product fields served by the 49 United States plants reporting production in 1961: ¹

¹ Source: Forest Industries, July 1962, p. 42.

LOCATION OF PALLET PLANTS

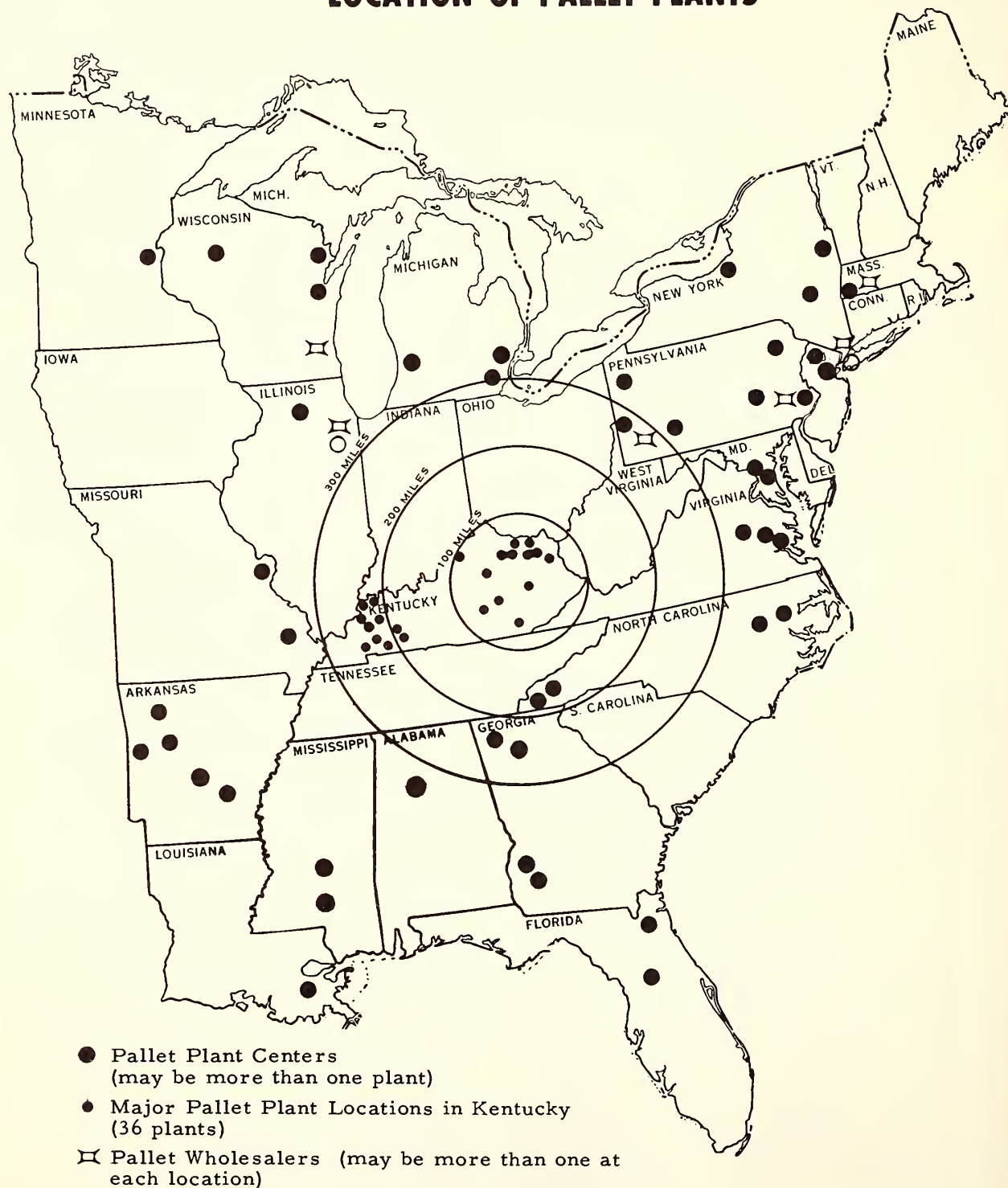


TABLE VIII-II
PARTICLEBOARD PRODUCTION, 1959-1962
(Million Square Feet)

AREA	1959	1960	1961	(Estimated) 1962	Rated (Active) Production Capacity
Northeast/North Central States*	37.3	38.0	30.7	38.1	60.0
Southern States**	107.7	103.2	124.0	148.8	288.4
Western States	<u>150.8</u>	<u>127.2</u>	<u>164.6</u>	<u>199.5</u>	<u>398.8</u>
United States (Total)	295.8	268.4	319.3	386.4	747.2

Source: 1959-61 data from Current Industrial Reports, BDSAF-586 (61)-1, June 5, 1962, "Particleboard 1961," U. S. Dept. of Commerce, Washington 25, D. C.

Rated production capacity based on data in Forest Industries, July 1962, pages 122-128.

*Northeast/North Central States: Pennsylvania, Indiana, Illinois. A plant with additional capacity of 23.0 million square feet is under construction in New York.

**Southern States: Virginia, N. Carolina, Kentucky, Tennessee, Mississippi, Arkansas, and Texas.

<i>Form or Application of Product</i>	<i>Number of Producing Plants</i>
Corestock.....	45
Furniture.....	39
Underlayment.....	25
Cut-to-size.....	30
Veneer overlay.....	20
Paper-plastic overlay.....	10
Cabinet stock.....	28
Prefinish.....	4
Primed.....	13
Floor tile.....	4
Construction.....	21
Siding (Exterior).....	2
Decorative.....	14
Edge banded.....	15
Other.....	12

While some of the original (smaller) captive plants—largely established to produce core stock for the furniture industry—are still in operation, almost all the plants produce board for core stock, as well as for a variety of other end uses.

Demand

In the absence of firm data on shipments by manufacturers, it must be assumed that

particleboard production is roughly equivalent to demand. Table VIII-II on page 127 shows U.S. Government estimates of production, 1959-1961, and a projection for 1962.

Although official U.S. Government production estimates for 1962 show only 354 million square feet, an increase of 11 percent over 1961, preliminary industry reports and other data suggest total production of 375-400 million square feet, or an increase of 20-25 percent for the year. While this figure is only about 50 percent of installed capacity, much of the existing capacity comprises specialized production units and obsolete or marginal units scheduled for retirement.

Largely because of the rapid growth of the particleboard industry, reliable statistics for consumption by industry sector are not available. It is generally agreed, however, that about 50 percent of all production is used by the furniture industry: i.e., in 1962, about 185-200 million square feet. Possibly another 150 million square feet is now being consumed by the construction industry, principally for floor underlayment, interior paneling, and built-in cabinets. A distinct spurt in the use of particleboard for residential

construction in 1962 has resulted from the promulgation of an industry standard and approval by FHA for use of the board as floor underlayment. Sales for this purpose were reportedly up 73 percent in January-June 1962, as compared to the same period of 1961. The development of phenolic board for exterior use will also help increase future sales of particleboard in the construction industry. The balance of current production is used in numerous applications in the automotive field (truck and trailer bodies), the electrical industry, and other fabricating industries.

After 1962, demand will probably continue to increase at a rate of 10-12 percent annually, reaching about 500 million square feet in 1965 and about 800 million square feet in 1970. These, of course, are conservative estimates based on average performance. National promotion by industry trade associations, research leading to new product applications, and aggressive sales programs can probably better this projection.

Kentucky's favorable location in the center of the largest furniture production area in the United States will insure any flakeboard plant there a reasonable share of this large and growing market for particleboard. The long term trend favoring increased residential construction, together with the increased use of asphalt tile, vinyl, and other plastic floor covering, will also insure a growing market for flakeboard within the market area served by a Kentucky flakeboard plant. Provisions for the production of panels for exterior sheathing may also be worth considering, since a larger potential market exists as construction techniques tend to minimize the use of sawn lumber. Decorative interior paneling for residential and commercial construction could provide another major product line, possibly by a satellite operation which would apply veneer or plastic overlays to flakeboard panels produced by the primary unit.

Solid Wood Paneling

Solid wood paneling is a long established product that is experiencing considerable increase in use as a decorative material applied to the interiors of commercial and residential buildings. A present upsurge in use, involving almost all types of wood paneling is attributed to a renewed appreciation of the aesthetic character of grain patterns and other appearance features that are unique to wood.

For many years the use of wood paneling was very much in disfavor, largely because varnish, shellac and other commonly used finishing materials tended to craze and darken with age. The unattractive appearance that resulted reflected against the popularity of paneling for architectural treatment. It was customary to paint paneling within a relatively short span of years following installation in order to hide the unsightly appearance that frequently developed as a result of aging.

Within the past decade, great strides have been made in perfecting non-deteriorating finishes and devising means of applying them in production. Present day finishes add to the natural beauty of wood in a lasting manner and avoid virtually all of the objections so justly levied against earlier finishing materials. Improvements in finishing materials and methods have been brought about by efforts of the plastics and chemical industry, which has teamed with some segments of the wood industry to develop materials and techniques that have made possible the excellent paneling products that are now available.

The plywood manufacturers have been the leaders within the wood industry in perfecting paneling products and promoting their use. Their success has led to the presently expanding market for all types of paneling, the greatest demand being for prefinished products.

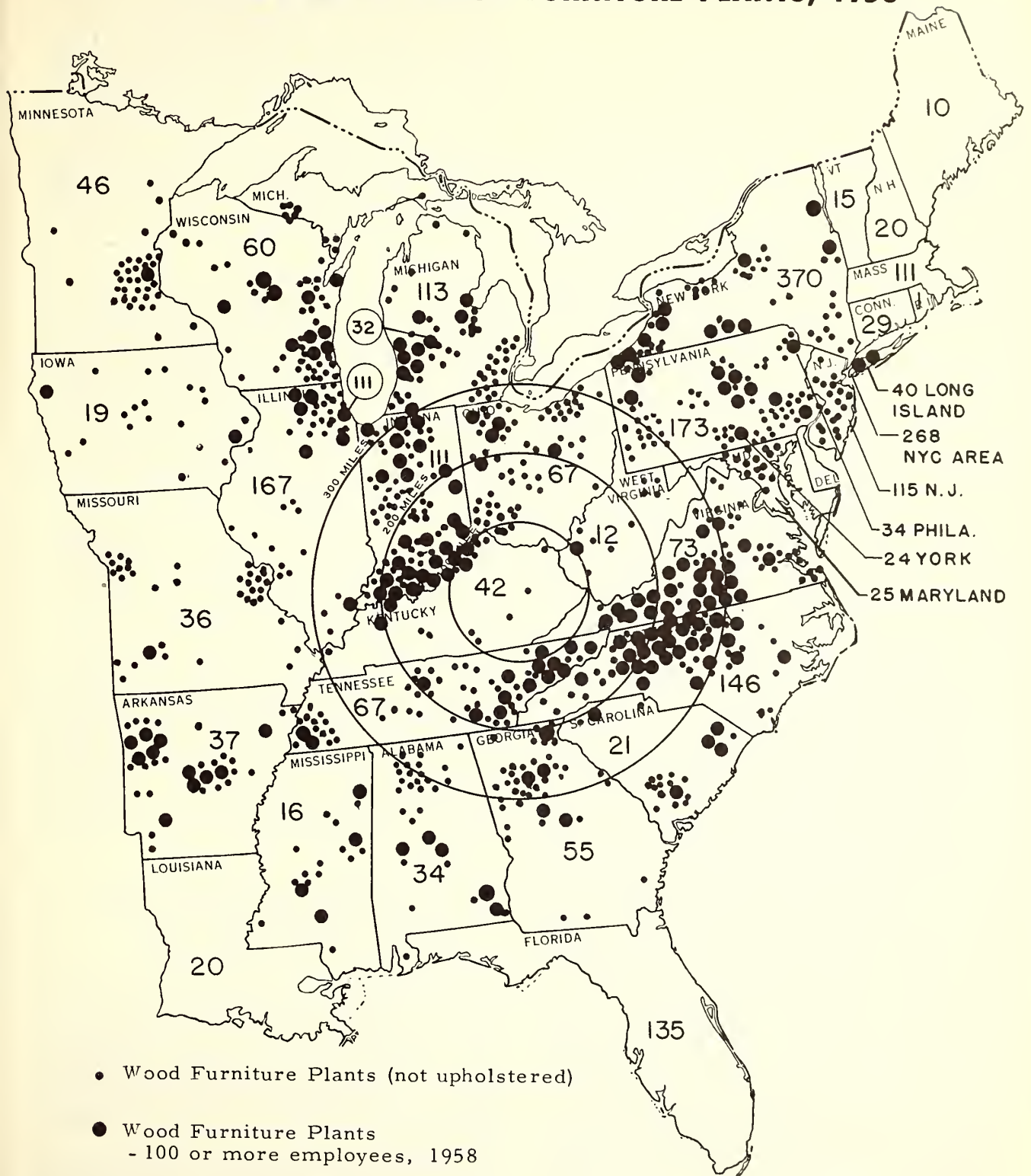
The manufacture and sale of solid wood paneling shows a close parallel to the great strides that have been made with plywood paneling.

Prices for paneling vary over a wide range and are closely associated with species and character of the wood: i.e., grain pattern, color, etc. Prefinished plywood paneling, in 4' x 8' sheets, sells in the price range from 42 cents to 75 cents per square foot, f.o.b. plant. Unfinished solid wood paneling in six inch, eight inch, ten inch, and twelve inch widths sells in the range from 25 cents to 65 cents per square foot; and prefinished solid wood paneling sells from 35 cents to 90 cents per square foot, f.o.b. plant.

Demand

No source of data could be found that exactly identified the scope of the market for paneling products. In general terms, however, an excellent market appears to exist for volume sales of the highest quality products, and there are strong indications that demand will stay at a high level for a number of years. Architects, manufacturers of ply-

LOCATION OF WOOD FURNITURE PLANTS, 1958



wood panels and manufacturers of overlaid particle board who presently supply the market for paneling look toward increased sales in the future.

Pallets

The development of the fork-lift truck during World War II and its general adoption by industry has made the allied pallet industry one of the fastest growing segments of the wood products industry. Pallets are cellular wooden platforms used in conjunction with fork-lift trucks; loads are placed on or in the pallet, which in its basic design has apertures for the forks of the lift truck, and can be moved at will by means of the fork-lift truck without additional handling. Since the introduction of the original platform-type pallet, modifications have extended to bin pallets, box pallets (for loose materials), and palletized shipping containers.

Pallets are generally made to the customer's specifications, though a few producers specialize in a limited range of sizes in order to utilize mass-production methods. There are about one thousand producers of pallets in the United States, but only about 200 "permanent" concerns. About 75 percent of all pallets are sold through wholesalers or brokers, a factor which probably contributes to the fact that the pallet industry has the highest mortality rate and the lowest profit margin of any segment of the wood products industry. Only about 25 producers can claim annual sales in excess of \$1 million. The market radius for the pallet industry is about 250 to 300 miles.

In 1961, there were 36 pallet producers in Kentucky, ranging in size from four employees to 128 employees. The average plant employed about 19 men. Production in Kentucky is concentrated in two major areas: the northeastern sector, in the vicinity of Morehead, and the southwestern section, near Hopkinsville. It is estimated that the 13 plants in eastern Kentucky employ about 400 persons and consume about 40 million board feet of lumber (mostly oak) each year. This area is well situated to serve a large number of industrial centers in Kentucky and surrounding states, and production can probably be expanded, particularly for a quality product using kiln dried lumber.

While the production and consumption of pallets has exceeded all expectations, the industry is concerned about the adverse effects of low quality products arriving on the market. An effort is being made to

induce pallet-makers to accept standards recently drawn up by the industry trade association; increasing use of the association service mark by licensed producers is expected to result in the elimination of some of the marginal producers from active competition. In the meantime, the trade association is also conducting "users' clinics" in an effort to educate industry to the advantages of pallets of all types. Any pallet plant envisaged for Kentucky should seek the guidance of the trade association—which welcomes new producers of quality products.

Demand

The rapid growth of modern materials handling techniques and the diversification of the original platform-type pallet has meant a steady long-term uptrend in demand for pallets. New types of pallets are entering the market, including box pallets for produce and palletized shipping containers. Although there have been some peaks and valleys, production (equal to consumption) since 1945 is as follows:

<i>Year</i>	<i>Production (Millions of units)</i>
1945.....	30
1950.....	23
1954.....	36
1958.....	44
1961.....	63

According to industry spokesmen, the trend has been steadily upward since 1958. By 1975, demand for pallets is expected to reach 75 million a year. The requirement for a quality product will become more important as major users change their accounting methods to consider pallets as a capital investment rather than a cost of production.

Unassembled Furniture and Consumer Kits

The advent of "do-it-yourself" in recent years has sparked a trend toward knocked-down or semi-assembled wood end-products of various types, including limited furniture lines, small boats, tool sheds and garden shelters, dog houses, bird feeders and bird houses, and similar items that can be assembled and finished by a relatively unskilled consumer.

Knocked-down furniture kits and most other do-it-yourself kits are marketed through mail order houses, department store chains,

supermarkets, and hardware stores without benefit of wholesalers. Markets are limited by low profit margins and high freight rates; and considerable competition has developed from imports from Eastern Europe and Finland—where lower labor and material charges permit economical production for export.

The industry is characterized by its concentration on a relatively few items. In the furniture and household goods field, for example, lines are incomplete and emphasize case goods, tables, outdoor furniture, decorative screens and room dividers, and bookcases. The design of most consumer items follows simple, modern lines and accents the use of simple joints and fasteners. Ideally, knocked-down kits are sold as complete units, including necessary sandpaper, glue, and hardware. Since most items are painted, high quality woods are not common.

Demand

The demand for knocked-down consumer items tends to be selective and is difficult to assess. Buyers of knocked-down furniture tend to fall at the lower end of the income scale, but young married couples and students also appear to account for a large portion of sales. In the latter case, however, the pattern is extremely selective: most young couples buy some standard furniture and augment it with such inexpensive do-it-yourself items as chests, bookcases, and tables. Recent data for some items of unassembled and unpainted household furniture suggests the size of the market for these products:

TABLE VIII-III SHIPMENTS OF UNASSEMBLED AND UNPAINTED FURNITURE ^{1/}				
PRODUCT	1958		1954	
	Quantity (1000 units)	Value (\$1000)	Quantity (1000 units)	Value (\$1000)
Kitchen cabinets, unassembled	582	10, 589	NA	NA
Chest of drawers, unpainted	604	7, 166	743	9, 154
Other unpainted furniture	--	14, 477	--	13, 626
Wood outdoor furniture and unpainted furni- ture not specified	--	6, 656	--	NA

^{1/} Source: 1958 Census of Manufacturers, MC58(2)-25A, Household Furniture, U. S. Department of Commerce, Washington 25, D. C.

The demand for boat kits, garden and tool sheds, bird feeders and bird houses, dog houses, etc., appears to be rising in proportion to the increase in outdoor living and do-it-yourself. In particular, it would appear that the development of recreational facilities in association with flood control projects in Kentucky will increase the demand for small boats of simple construction. Production and marketing of such products, however, must be geared to detailed market studies and aggressive marketing techniques not possible in the course of this study.

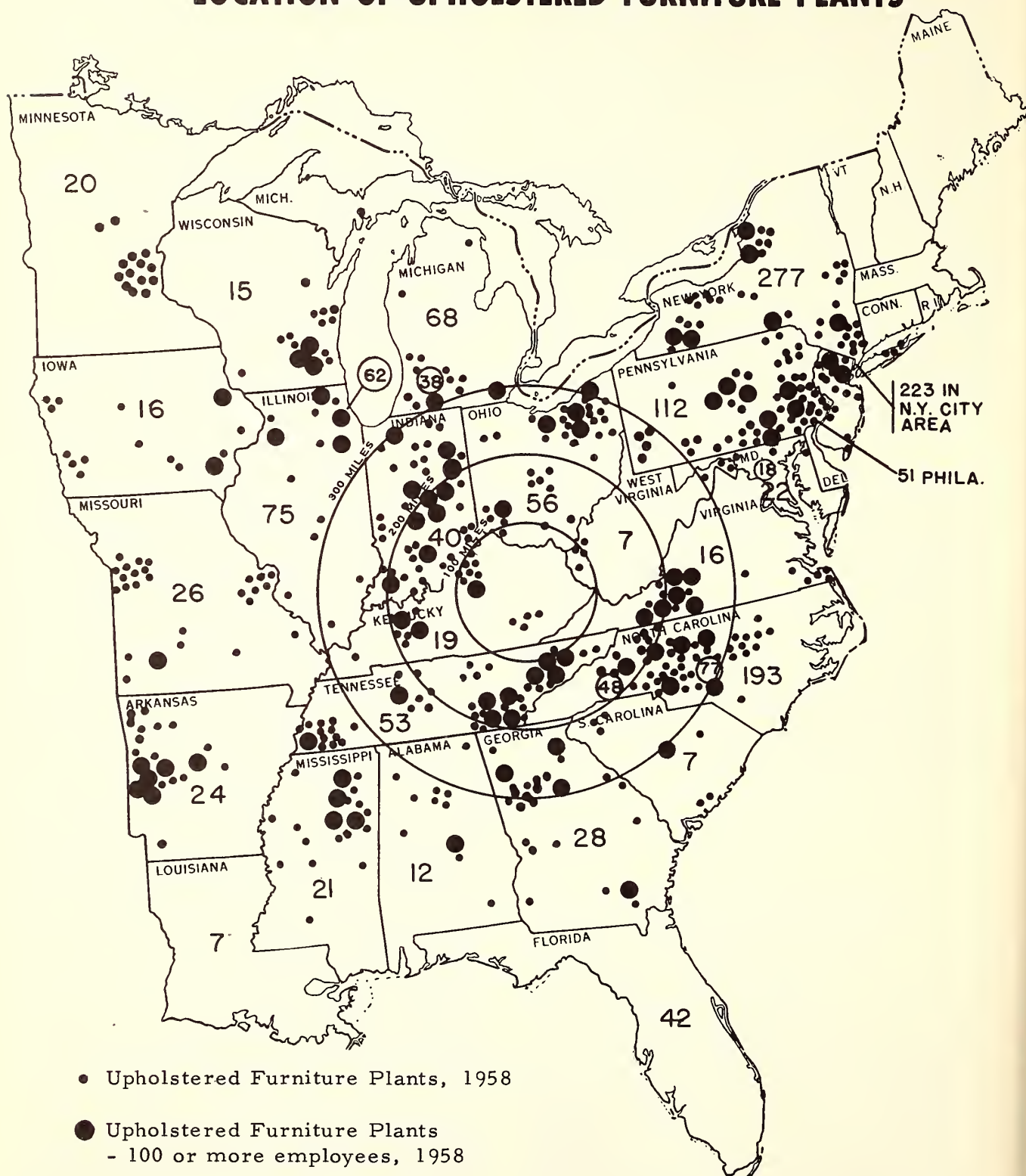
Frames and Parts for Upholstered Furniture

Pre-cut and semi-assembled frames and/or parts for upholstered furniture are used extensively by furniture manufacturers, many of whom lack the facilities to produce their own. Frames are produced to the buyer's specifications and are usually shipped in knocked-down condition, either as kits or in bulk, for assembly at the destination.

The decentralized production of frames for upholstered furniture is a comparatively recent development, and one which opens up a small but lucrative market. Since the frames are generally assembled at destination, the advantage to the producer is that frames (and parts) may be made on the same equipment used for production of hardwood dimension. The quality standards for the materials used in furniture frames—principally "soft" hardwoods—may be somewhat lower than those applied to dimension stock. Considerable poplar and gum are used. The opportunity to use raw materials of lower grades and differing species than required for dimension permits the producer otherwise unexpected economies of operation. Further, the production of frames and parts does not require the highly skilled (and highly paid) personnel common to the upholstered furniture industry.

In addition to frames, destined to be covered by upholstery, the same producer can supply furniture parts (arms, legs, etc.) exposed to view in the finished piece. These parts are usually shaped according to the buyer's specifications but are not finished. A limited line of standard frames can be assembled for shipment to small custom upholstery shops, or, alternatively, the frames and associated pre-shaped parts can be packaged into kits designed for easy assembly by the same type of customer and marketed through jobbers.

LOCATION OF UPHOLSTERED FURNITURE PLANTS



Demand for Frames

The plant location map on page 132, shows the distribution of upholstered furniture manufacturers in the eastern United States. About 375 plants accounting for 35-40 percent of total United States production of upholstered furniture are located within a radius of 300 miles from eastern Kentucky. If nearby States (beyond 300 miles) are added, eastern Kentucky is seen to be centrally located in an area that produces about 70 percent of all upholstered furniture manufactured in the country. Moreover, the majority of the larger upholstered furniture plants—those employing more than 100 employees—are located within the primary market for eastern Kentucky.

TABLE VIII-IV				
UPHOLSTERED FURNITURE (Value of Shipments in \$1000)				
1958	1959	1960	1961	1962*
\$764,691	\$869,399	\$759,958	\$712,926	\$780,000

* estimated

In 1958, the upholstered furniture industry consumed furniture frames and parts valued at about \$36.5 million. On the basis of slightly increased production and of greatly increased acceptance of premanufactured frames, the current demand should be \$40-\$45 million annually. Because of its favorable location, eastern Kentucky is in a position to tap a primary market (300 miles radius) amounting to \$13-\$15 million a year. Extension of the market area to other producers in Chicago, Milwaukee, Grand Rapids, Philadelphia, New York City, and Baltimore—including many small producers lacking their own facilities to produce frames—could increase this potential market to \$20-\$22 million a year.

Over the long term, this market will become intensely competitive as the demand for upholstered furniture stabilizes. Contrary to the situation in the furniture market as a whole, the production of upholstered furniture has reacted to the recent trend toward Scandinavian-design modern furniture, with its emphasis on exposed fine woods. A countertrend toward traditional furniture and reproductions of antiques probably will help stabilize the upholstered furniture industry but will not result in dramatic increases in sales.

Animal Litter

Wood shavings are widely used as bedding for livestock, poultry, and laboratory animals because of their high absorptive capacity, cleanliness, and resistance to matting. Discarded shavings are subsequently used for their manure content. A source of additional nitrogen is required when the refuse is used as manure or a mulch, since the biological decomposition of the wood is carried out by organisms that require nitrogen. The U.S. Department of Agriculture recommends the use of about 50 pounds of ammonium sulfate (to supply the necessary added nitrogen) for each ton of shavings—thus the problem is not serious in any event. The nitrogen requirement for hardwood shavings is less than for softwood.

Although the market is not organized and shavings are largely secured from local saw mills and planing mills, the great potential market promises to make the packaging and shipment of shavings commercially feasible. The price of shavings ranges from about \$6 to \$34 a ton, delivered, depending upon the distance from the mill. The major factor is that the price must be competitive with locally available straw and ground corn cobs (for poultry), bedding materials which are about as satisfactory as shavings. For commercial sales, shavings should be baled to permit easy handling. Maximum absorption can be achieved by air drying the material before packaging.

Shavings are also a preferred material for litter required by commercial breeders of laboratory animals. A ready market for this material exists within the triangle Indianapolis-Madison (Wisc.)-Detroit, where many breeders, pharmaceutical plants, and research laboratories are located. A far larger market exists on the East Coast. The potential market, largely untapped on a commercial scale, can be estimated from the following data on annual national production of laboratory animals:

Animal Type	Annual Production	United States 1962 (est.)
	1957	
Mice.....	20,000,000	40,000,000
Rats.....	6,000,000	12,000,000
Guinea pigs.....	600,000	1,200,000
Hamsters.....	400,000	800,000
Rabbits.....	300,000	600,000

Although white pine shavings are favored by most users, poplar shavings are very acceptable—thus fitting in with the raw material resources in Kentucky. Certain

specialized requirements must be met for breeders of laboratory animals, however, including preliminary steam cleaning to remove insects and feces and other contaminants likely to be deposited by wild rodents in the vicinity of the producing mill. Paper or plastic wrappings applied upon baling of cleaned litter helps keep the material free of further contamination. A "specialty market" for steam cleaned and sterilized shavings, packed in plastic bags, can probably be developed, particularly for the smaller breeders who cannot afford autoclaves in which to sterilize the litter they buy.

A random sampling of commercial breeders showed that they prefer shavings in bales of about 50 pounds. Current prices, when given, range between 70 cents and \$1.10 for a 50-pound bale. Most breeders indicated that they would prefer to use shavings if they could find a reliable source of clean material at a reasonable price. One breeder reported paying \$90 a ton for loose shavings.

Demand

The use of wood shavings for poultry litter has increased rapidly. A U.S. Department of Agriculture report estimated United States demand for all types of poultry litter as follows:

Year	Litter Requirements
1935.....	8,000,000 tons
1949.....	12,000,000 tons
1952.....	13,300,000 tons
1960.....	15,500,000 tons

Independent estimates made during the course of this study show an annual requirement for about 2,540,000 tons of litter for poultry and 105,000,000 tons for livestock (cattle and hogs) for the State of Kentucky and the seven bordering States. If four additional southern States are added—where, however, pine shavings are abundant, the potential market for poultry litter triples. Kentucky is ideally situated to supply the livestock areas in Illinois, Indiana, Ohio,

TABLE VIII-V
PRINCIPAL POULTRY RAISING CENTERS IN KENTUCKY MARKET AREA

	DISTANCE FROM MANCHESTER, KENTUCKY		
	Within 100 miles	100 to 200 miles	200 to 300 miles
Chickens (including commercial broilers)	No major centers	Southern Indiana, near Ky border NW N. Car., north of Charlotte N. Central Ga. (near Atlanta) S. Ohio, scattered	Southbend-Elkhardt, Indiana Near Cleveland, Ohio NW Va. (Shenandoah Valley) Central N. Car., south of Greensboro
Turkeys	Near Winchester, Ky	SW Indiana (North of Evansville) S. Ohio (scattered) E. Tennessee (")	Central Indiana Southbend-Elkhardt, Indiana N. Ohio (S. of Akron and scattered) NW Virginia (Shenandoah Valley) N. Central S. Car., (from Spartanburgh to Rockville) Western part of Central Ga., near Columbus

Estimated 750 million birds in radius of 300 miles = 5.76 million tons litter/year.
25 million head of livestock, 300 mile radius = 50 million tons of litter/year.

DISTRIBUTION OF CHICKENS, BROILERS AND TURKEYS

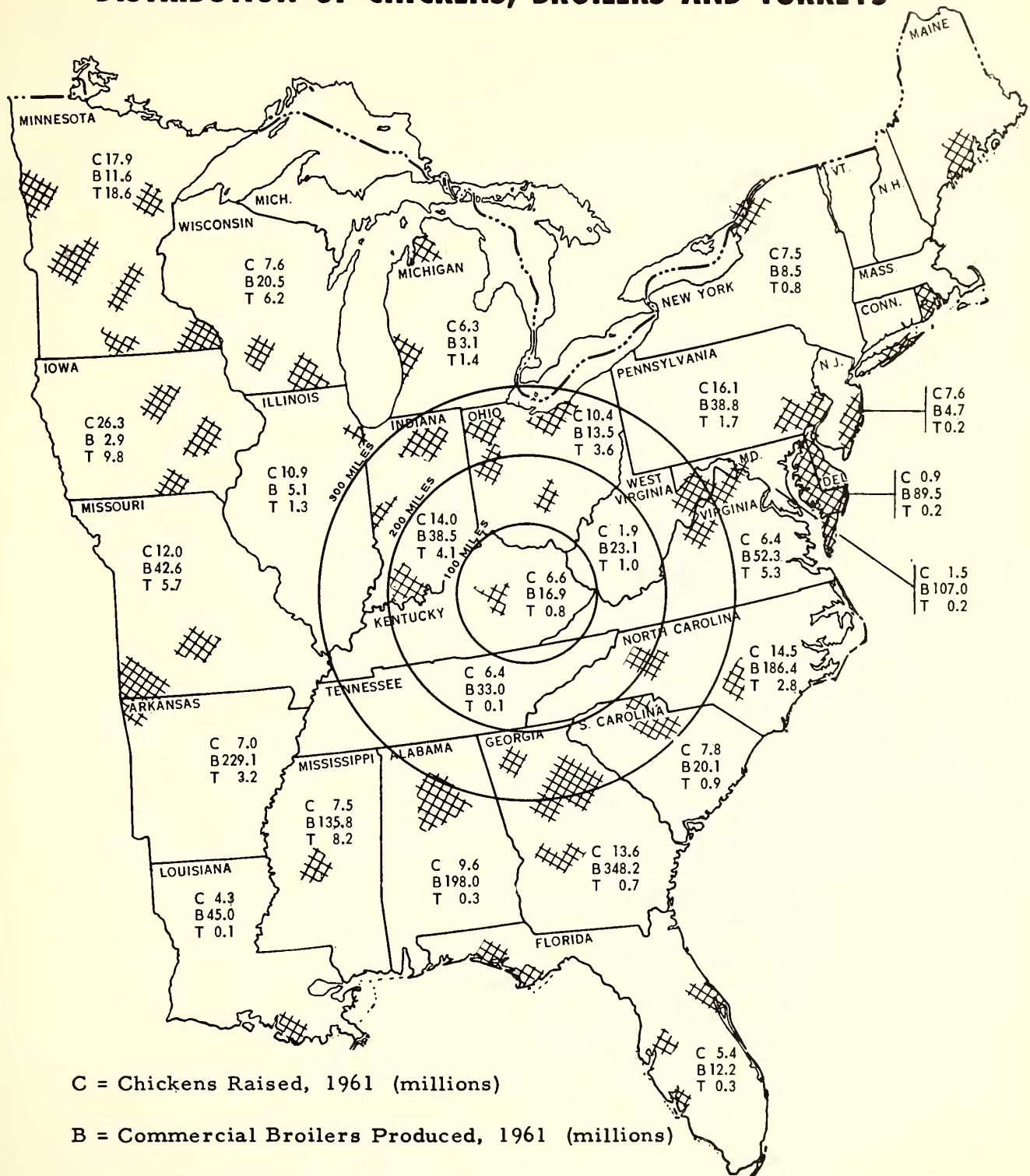


TABLE VIII-VI

REQUIREMENTS FOR POULTRY AND LIVESTOCK LITTER
1962 ^{1/} (Thousands of Tons)

STATE	POULTRY LITTER	LIVESTOCK LITTER (Hogs and Cattle)	TOTAL LITTER
<u>CONTIGUOUS STATES ONLY</u>			
Kentucky	211.3	7,200.0	7,411.3
Illinois	177.8	23,200.0	23,377.8
Indiana	474.0	14,400.0	14,874.0
Ohio	240.3	9,800.0	10,040.3
W. Virginia	199.5	600.0	799.5
Virginia	435.5	4,000.0	4,435.5
Tennessee	317.8	6,600.0	6,917.8
Missouri	<u>483.8</u>	<u>16,400.0</u>	<u>16,883.8</u>
Subtotal	2,540.0	82,200.0	84,740.0
<u>NEARBY STATES (300 Mile Radius)</u>			
Alabama	1,605.8	5,200.0	6,805.8
Georgia	1,783.3	6,000.0	7,783.3
South Carolina	250.5	2,000.0	2,250.5
Mississippi	1,112.8	5,200.0	6,312.8
North Carolina	<u>1,086.3</u>	<u>4,400.0</u>	<u>5,486.3</u>
Subtotal	<u>5,838.7</u>	<u>22,800.0</u>	<u>28,638.7</u>
TOTAL	8,378.7	105,000.0	113,378.7

^{1/} Litter requirements (from Dept. of Agriculture)

Chickens - 25 lbs/year/animal
Broilers - 15 lbs/year/animal

Turkeys - 5 lbs/year/animal
Livestock - 2 tons/year/animal

DISTRIBUTION OF CATTLE AND HOGS

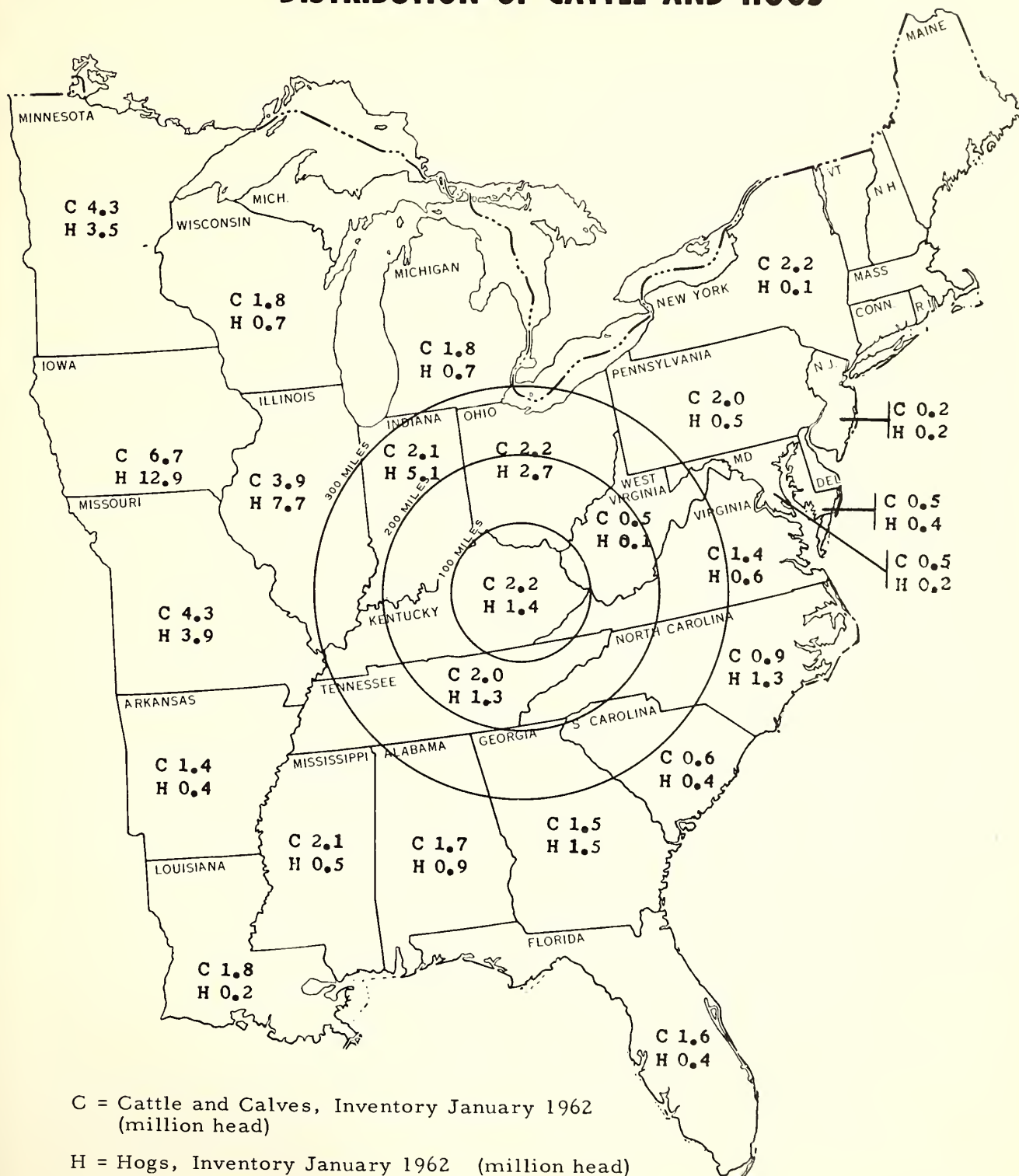


TABLE VIII-VII

ANNUAL LITTER REQUIREMENTS, EASTERN USA
(Less New England)

STATE	Thousand Tons		
	POULTRY LITTER	LIVESTOCK LITTER	TOTAL
Minnesota	357.5	15,600.0	15,957.5
Iowa	375.0	39,200.0	39,375.0
Missouri	483.8	16,400.0	16,883.8
Arkansas	1,813.8	3,600.0	5,413.8
Louisiana	241.5	4,000.0	4,241.5
Wisconsin	264.3	12,400.0	12,664.3
Michigan	105.5	5,000.0	5,105.5
Illinois	177.8	23,200.0	23,377.8
Tennessee	317.8	6,600.0	6,917.8
Mississippi	1,112.8	5,200.0	6,312.8
Indiana	474.0	14,400.0	14,874.0
Kentucky	211.3	7,200.0	7,411.3
Alabama	1,605.8	5,200.0	6,805.8
Ohio	240.3	9,800.0	10,040.3
Georgia	1,783.3	6,000.0	7,783.3
New York	159.5	4,600.0	4,759.5
Pennsylvania	496.5	5,000.0	5,496.5
Virginia	435.5	4,000.0	4,435.5
West Virginia	199.5	600.0	799.5
North Carolina	1,086.3	4,400.0	5,486.3
South Carolina	250.5	2,000.0	2,250.5
Florida	154.8	4,000.0	4,154.8
New Jersey	130.8	400.0	530.8
Delaware	683.0	184.0	867.0
Maryland	821.8	700.0	1,521.8

and Missouri. Probable annual demand for litter within a 300 mile radius of eastern Kentucky, based on 1962 poultry and livestock populations/production, is about 5.75 million tons for poultry and 50 million tons for livestock.

The demand for litter to be used in connection with commercial breeding and laboratory animals is harder to estimate, except on a broad national basis. If all breeders were to use shavings for litter, the potential market would be about 5000 tons a year for a gross return of about \$250,000, based on a nominal price of about \$50/ton. The use of shavings by research laboratories for animal colonies could double these figures. This is a small but highly lucrative market well worth further investigation. According to industry spokesmen, the demand for a good quality natural litter is great enough to warrant shipment far beyond the arbitrary 250-300 mile limits used in most of the market studies made in connection with this project.

Bark Mulch

The use of ground bark as a mulch and soil conditioner is a new product application that has been successfully promoted in various parts of the country. Its promotion must be directed to overcome a resistance to use of wood residue materials as mulch that is a result of bad experiences during widespread attempts many years ago to use sawdust for this purpose. Nitrogen depletion of soil due to bacterial action involved in the decay of sawdust was incorrectly interpreted as a toxic effect upon plants by the sawdust itself.

Soil bacteria acting on organic matter incorporated in the soil require nitrogen for their growth. The total nitrogen demand depends on the growth of bacteria, which is related to the concentration of organic matter and rate of decomposition. When the nitrogen demand becomes an appreciable proportion of the available supply, competition for nitrogen develops between the bacteria and crops or other vegetation, tending to cause nitrogen starvation in the plants and limiting the decomposition rate. This nitrogen competition terminates when decomposition is complete, and the nitrogen taken up by the bacteria is returned to the soil as the bacteria die. Nitrogen starvation obviously is a temporary effect that can be prevented by adding a nitrogenous fertilizer to the organic material applied to the soil. If this is not done, the effects of nitrogen starva-

tion can be avoided by letting the treated area lie fallow during the decomposition period.

Wood particles or sawdust incorporated into the soil usually decompose completely during one growing season. Bark, especially the outer bark, usually decomposes more slowly than wood and the nitrogen demand may not rise enough to cause severe competition for it, hence the nitrogenous fertilizer added may be reduced appreciably below that required when wood is the mulching material.

In mulching applications, decomposition proceeds more slowly than when the material is mixed into the soil. The decomposition occurs at the soil surface and may be extended slightly into the soil by the action of worms and other microfauna. The bacterial demand for nitrogen is of no consequence when the mulch is applied as an erosion preventative, but if the mulch is applied on a crop area, a combination of unfavorable conditions may result in some nitrogen starvation. This may occur when the nitrogen supply in the soil is low, when the climate is hot, and when the bark is from young trees or a species having a thick inner bark.

In general, species is of no major importance in the use of bark as a mulch, with the possible exception of walnut. This species is suspected of having inhibitory effects on vegetation under or near growing trees, but it is not clear whether the observed effects are real or accidental, nor whether, if real, they are caused by root competition or leachates from leaves or nut husks.

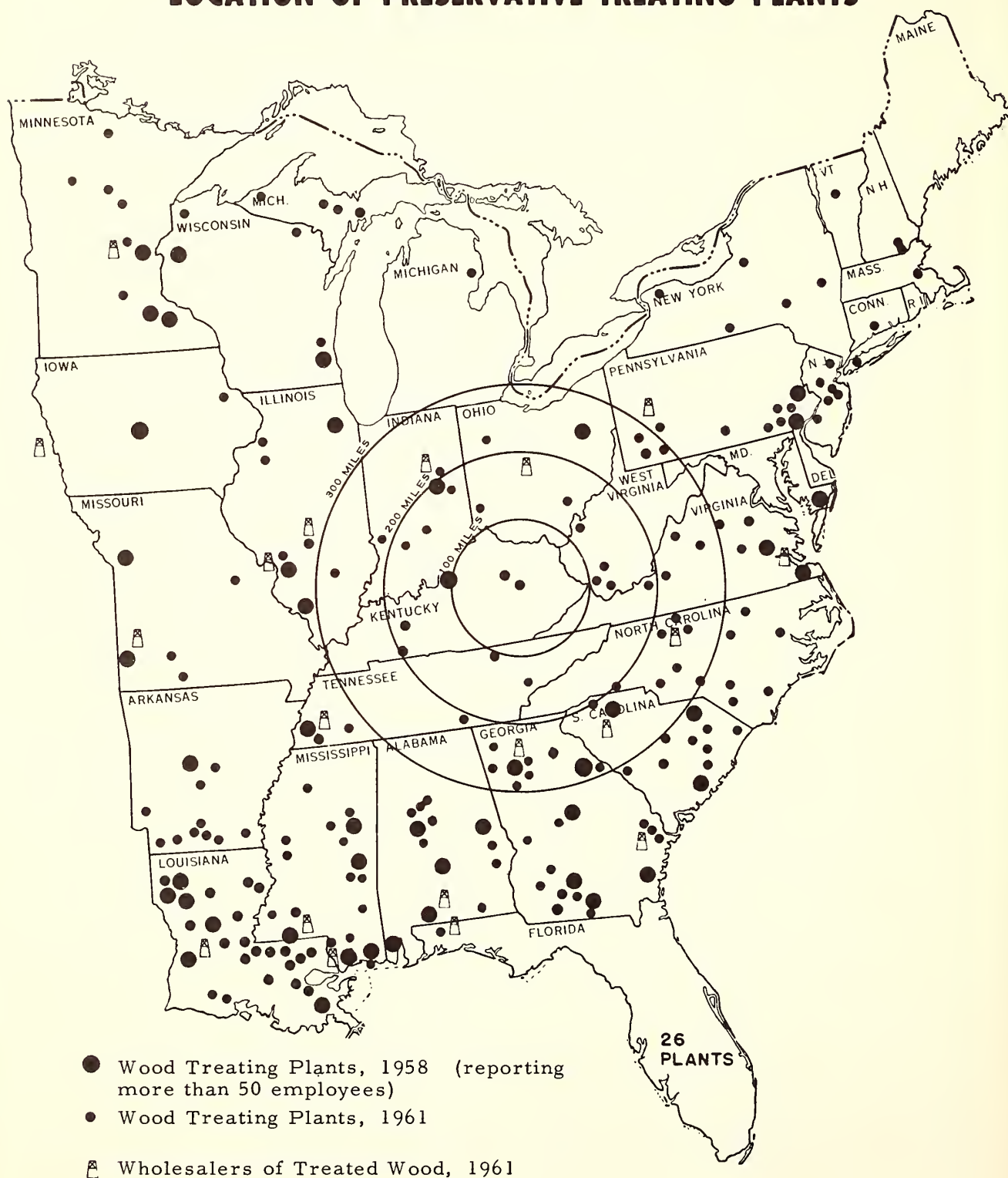
Demand

The relative newness of bark mulch as a product has prevented development of data applying to existing or potential consumption. Interviews with nursery supply houses and wholesalers of horticultural products have indicated a good market potential.

Prices for bark mulch tend to be high. One product identified at 100 percent "organic shredded hardwood bark" was found in Kentucky that retailed at \$2.70 for a bag containing three cubic feet. On the whole the price was found to be about equal to that charged for peat moss.

Mulch is sold primarily through nurseries and garden supply, feed and seed stores. The foremost competitor is peat moss, which has long been the standard in the nursery industry. Bark products seem to be superior to peat moss in several ways. For instance, they last about three times as long as peat moss in the soil and they tend to be more

LOCATION OF PRESERVATIVE TREATING PLANTS



effective in keeping soil from packing. The recommended product has no fertilizer value and should be sold only as a mulch and soil conditioner.

Preservative Treated Posts, Poles, and Lumber

Wood preservatives of various types are used to retard decay and to minimize insect damage to exposed wood products, such as utility poles and crossarms, lumber and timbers, crossties and switch ties, fence posts and rails, marine piling, etc.

Although the initial impetus to the wood preserving industry came from the railroads, many of which long ago operated their own creosoting plants for treating crossties, switch ties, piling, and bridge timbers, the industry has been undergoing a process of adjustment to new techniques and new product lines. Creosote, creosote derivatives, and mixtures of creosote and petroleum are still used in the largest quantities, but the use of pentachlorophenol, chromated zinc chloride, and such patented preservatives as Wolman Salts, Celcure, Protexol, and Osmosalts is firmly established. Many of these newer preservatives are suited to products where the color and odor imparted by creosote is objectionable; some of them—including Osmosalts—permit the application of paint without any special surface treating. Early reports that such chemical preservatives harmed livestock, either on direct contact or by ingestion of "contaminated" vegetation, have been proved to have no foundation.

At the same time that competitive preserving techniques have been developed, markets for some traditional products are shrinking, largely because of the declining role of the railroads, which have traditionally accounted for 50 percent of the market. The market has been fairly steady for treated poles, lumber and timbers, piling, and cross-arms; the market for fence posts, treated plywood, and mine timbers appears to be increasing.

In the face of technological improvements in the treating industry and declining demand for certain treated products, the industry is now operating at about 60 percent capacity. At least part of this unused capacity represents the withdrawal of inefficient producers from active operations. It can be concluded, on the other hand, that the larger and relatively more efficient producers are successfully meeting the challenge of competition and are enlarging their shares

of the market—partly by diversifying operations. Two examples of this trend are Koppers, which operates 34 plants (including two in Kentucky), and Osmose Preserving Co., which has been expanding its sales of treating plants at a rapid pace.

In 1961, there were seven commercial treating plants in Kentucky (five pressure plants), more than 20 within a radius of 200 miles of eastern Kentucky (including those in Kentucky), and more than 60 within a radius of 300 miles. Of these plants, at least 30 treat with creosote, 16 use an oil-pentachlorophenol mixture, and 32 use water-borne preservatives—such as Osmosalts. Two of the plants using water-borne preservatives are located in Kentucky. About 28 wood preserving companies maintained sales offices for the State of Kentucky in 1961; none of these offices are located in Kentucky, though about 25 percent of them are within 150–200 miles of the State line.

Demand

The market for preserved wood products is expanding in unforeseen ways, partly because of educational campaigns carried on by the industry in an effort to make up for declining sales in certain areas. The rapid expansion of rural electrification, the development of new building techniques such as pole barns, and the application of preservatives to lumber and plywood used for exterior construction have created steady markets for preservative treated products.

The use of preservative-treated fence posts and railings is gaining favor with farmers and appears to be of special interest to the horse breeders of the Kentucky Bluegrass region—particularly if the treated products can be painted easily. A survey conducted during the period of this study revealed a potential annual demand for nearly one million board feet of treated red oak fence rail (1" x 6" x 16') and about 58,000 treated sawn red oak fence posts in the Bluegrass region. About half the demand for fence posts is not being met, but almost none of the fence rail is known to be treated.

In other regions of Kentucky, farmers rely to a large extent on untreated, locally cut black locust, eastern red cedar, osage orange, and sassafras for fence posts, a fact that has tended to keep fence post prices low. At the present time, therefore, the market for posts outside the Bluegrass region is small. An educational campaign is probably required to put across the benefits of treated fence posts, with their average life

of 30 years, as opposed to a somewhat higher initial cost. It is possible that regionally available yellow pine posts can be treated and marketed in Kentucky.

Where treated fence posts are now used in Kentucky, they are often southern pine shipped from treating plants in Alabama and Arkansas. Some typical prices for treated fence posts in several regions of Kentucky, developed during the survey, are as follows:

REGION	3" TOP DIAM	4" TOP DIAM	5" TOP DIAM	REMARKS
Western Ky.	45¢	64¢	--	FOB Hot Springs, Arkansas
	56	89	\$1.20	FOB Mt. Vernon, Illinois
	60	82	1.23	FOB Centreville, Alabama
Bluegrass	68	86	1.19	FOB Guthrie, Kentucky
Northern		85	0.95	Average price farmers would pay for treated posts

Despite the tendency to use steel and aluminum highway guardrails, signposts, and right-of-way fencing, industry research has proved that preservative treated wood posts, rails, and poles are cheaper, stronger, and more durable. Maintenance costs, a major factor when metal posts and poles are used, are virtually eliminated. The proposed highway construction programs in Kentucky and nearby States could provide an attractive market for preservative-treated products. In the case of Kentucky, however, it would be necessary to change State highway specifications to permit the use of native woods and treatment by Osmo-salts; steps have been taken to insure these changes. A known requirement exists over a ten-year period for about 525,000 fence posts for right-of-way fencing along limited access highways; many of these posts could be treated wood if the highway specifications are changed. Additional requirements will be generated during the long-term construction of some 15,000 miles of other State and county roads in Kentucky; with an average of 100 guardrail posts each mile, a potential initial demand for 1.5 million posts can be anticipated. Signposts, right-of-way fencing, roadside parks and picnic areas, and other construction along these roads will create demands for still more preservative-treated wood posts and poles. The development of State parks in association with Kentucky's flood control and water-shed pro-

grams will also provide additional markets for preservative treated posts, poles, and lumber. It is, or course, obvious that similar demands will be generated in adjacent and nearby States less favored with forest resources.

Finally, railroad companies are becoming increasingly aware of the economies to be derived from the use of treated lumber for railroad car decking and other wood components; the life of these wooden components is increased three times by preservative treatment. A considerable market is said to exist in Kentucky and nearby States for treated poles used in the erection of "pole barns" and other structures. A small but growing demand is also being generated for treated lumber used in building bunker type silos. In the utility field, the treatment of crossarms should provide an important market in Kentucky; while the many coal mines in eastern Kentucky should provide a market for treated mine timbers. At this stage, however, definite data for these potential local markets are not available.

Wood Chips

Hardwood chips are used in place of round-wood pulp logs in the expanding pulp and paper industry to augment softwood pulp-wood supplies, particularly by sulfate (kraft) pulp mills. Recently developed processes for producing hardwood pulp—notably the cold soda process—and the growing pressure on supplies of softwood pulpwood outside the southern States combine to focus industry attention on increased use of available hardwoods, particularly in the production of newsprint and other pulp and paper products.

Chips used in the manufacture of pulp are (1) derived from peeled green hardwood pulp logs by means of a mechanical chipper, or (2) developed by chipping solid sawmill waste. Portable debarkers and chippers are sometimes set up along a railroad siding to process pulp logs trucked from the woods; chips produced in this manner are usually loaded directly into railroad cars for shipment to a pulp mill. With regard to solid waste, a typical hardwood sawmill will produce about .5 tons (dry weight) of chips for each thousand board feet of lumber manufactured.

Chips are usually sold on the basis of cord-equivalents; one cord equivalent of poplar, for example, is about 2.5 tons at 86 percent moisture content. A minimum railroad car load is about 15 cord-equivalents.

Prices for chips vary from plant to plant,

TABLE VIII-IX

MATERIALS TREATED, BY ITEM AND PRESERVATIVE, IN THE UNITED STATES, 1957-61*

Preservative	Year	Poles	Crossties	Lumber and timbers	Fence posts	Piling	Switch ties	Crossarms	All other ¹	Total
Creosote and creosote-coal tar	1957	55,708,018	60,745,820	19,087,569	6,684,387	15,683,999	5,159,633	1,944,267	2,605,638	167,619,231
	1958	45,210,166	43,824,086	16,013,329	6,663,985	15,639,850	4,945,039	1,111,803	2,735,060	136,143,348
	1959	44,680,364	26,559,418	15,386,255	6,395,092	13,816,193	3,140,602	1,134,889	2,299,788	113,412,601
	1960	41,514,802	31,597,812	15,380,685	5,875,939	15,038,723	3,240,696	1,157,162	2,378,663	116,204,482
	1961	42,287,095	33,935,753	13,480,350	6,633,903	13,438,976	3,153,948	1,010,896	2,818,363	116,759,284
Creosote-petroleum	1957	1,211,416	40,208,520	3,234,799	3,102,893	480,640	2,845,565	31,793	262,673	51,378,299
	1958	641,235	29,864,910	2,932,964	3,528,539	467,893	1,683,066	15,371	574,125	39,708,103
	1959	1,174,529	25,016,772	2,952,993	3,536,352	634,624	1,234,301	5,070	635,499	35,290,140
	1960	581,000	25,263,156	2,985,754	2,357,507	842,578	1,638,541	11,706	522,902	34,203,144
	1961	1,439,819	21,584,618	2,395,529	2,770,254	603,907	1,530,326	24,482	279,156	30,628,091
Petroleum-pentachlorophenol	1957	25,104,963	278,428	4,729,574	3,099,011	102,957	29,437	2,623,931	418,606	36,386,907
	1958	24,611,290	67,760	4,748,347	4,255,466	66,925	6,373	2,239,764	490,110	36,490,035
	1959	23,951,744	80,796	6,444,036	5,343,290	82,577	17,234	2,415,448	860,205	39,195,330
	1960	24,445,069	107,843	7,177,563	4,920,987	238,423	21,196	2,542,416	903,176	40,356,673
	1961	23,790,119	172,235	8,300,067	5,245,002	276,974	20,247	2,489,325	903,519	41,197,488
Tanalith (Wolman Salts*)	1957	8,657	0	6,087,998	200,941	0	1,741	0	188,606	6,487,943
	1958	11,202	234	6,356,013	156,590	0	0	116	85,338	6,609,493
	1959	15,460	0	6,736,327	156,541	4,692	0	0	91,399	7,004,419
	1960	6,698	716	6,349,986	149,811	30	964	0	179,563	6,687,768
	1961	8,886	15,333	6,401,588	147,252	229	1,000	0	181,994	6,748,282
Creosote-pentachlorophenol	1958	2,239,362	0	4,286	247	0	0	308	279	2,244,482
	1959	7,399,717	142,960	69,003	23,474	56,896	36,140	5,493	13,033	7,746,656
	1960	7,586,861	0	3,645	1,654	1,618	0	10,765	1,497	7,606,040
	1961	8,684,279	0	5,699	34,644	7,767	0	113,666	1,278	8,847,333
Osmosalts*	1957	497,336	295,454	1,266,242	266,326	350	29,256	1,200	1,073,812	3,429,976
	1958	67,817	177,512	1,869,216	229,056	3,714	33,488	0	780,521	3,161,324
	1959	82,060	188,450	2,234,750	237,566	4,530	20,566	0	859,258	3,627,180
	1960	124,133	82,712	2,246,973	172,008	5,107	24,247	0	800,434	3,455,614
	1961	121,588	60,197	2,290,874	162,612	4,330	14,806	0	634,393	3,288,800
Chromated zinc chloride	1957	316	0	2,278,642	291	0	0	0	108,440	2,387,689
	1958	47,001	0	2,122,659	306	0	0	0	113,986	2,283,962
	1959	17,187	0	1,913,183	0	0	0	0	117,273	1,932,643
	1960	2,790	0	1,401,323	8,438	0	0	0	71,612	1,484,763
	1961	1,672	0	1,426,304	180	0	0	0	78,641	1,506,797
Celcure*	1957	0	0	1,782,531	0	0	0	0	533	1,783,064
	1958	0	0	1,640,804	7,898	0	0	0	2,281	1,650,983
	1959	47,314	0	2,133,232	12,200	280	0	43	1,268	2,194,337
	1960	430	0	2,093,243	11,476	0	0	79	1,256	2,105,256
	1961	0	0	2,105,065	0	0	0	0	1,275	2,106,340
All other	1957	1,490,745	1,143	2,754,703	30,629	1,798	219	375	748,728	5,028,340
	1958	985,249	0	2,677,585	44,125	9,751	0	0	769,979	4,486,689
	1959	925,856	148,401	2,030,646	33,576	7,687	84	314	961,439	4,108,003
	1960	837,736	107,447	1,879,378	28,485	280	0	17	1,155,606	4,008,949
	1961	112,796	2,120	2,411,917	20,810	601	12,574	0	1,749,192	4,340,010
All preservatives	1957	84,021,451	101,529,365	41,222,058	13,384,478	16,269,644	8,065,851	4,601,566	5,407,036	274,501,449
	1958	73,813,322	73,934,502	38,365,213	14,890,212	16,188,133	6,667,996	3,367,362	5,551,679	232,778,419
	1959	78,277,231	52,136,797	39,902,425	15,738,091	14,557,419	4,498,927	3,561,257	5,019,162	214,511,309
	1960	75,099,519	57,159,686	39,519,150	13,526,305	16,146,759	4,925,644	3,722,145	6,013,481	216,112,689
	1961	76,438,254	55,770,256	38,847,393	15,014,657	14,332,784	4,782,901	3,638,369	6,647,811	215,422,425

*Reg. U. S. Pat. Off.

¹All fire-retardant treatment included in All other.²Included in All other.

Source: "Wood Preservation Statistics, 1961"

*CUBIC FEET

but one mill near eastern Kentucky has been paying \$7.50 to \$8 a ton (green weight) delivered. F.O.B. price is about \$5 a ton (green weight). Most shipments of hardwood chips from eastern Kentucky are now made by truck, but the railroad lines operating in the region also haul chips to nearby pulp mills. It is apparent, however, that the marketing radius is limited by freight charges.

Demand

Although there are more than a dozen pulp mills within a nominal marketing radius of eastern Kentucky, only one or two can be regarded as consumers of hardwood chips from the region. The Meade Paper mill at Chillicothe, Ohio, is currently buying about

one-third of its daily requirements of raw material in the form of chips in eastern Kentucky. An additional market for about 80 to 100 tons daily may exist at this one plant. The other plant is the Diamond National pulp products plant at Middletown, Ohio, near Cincinnati, which may be a potential market for hardwood chips. In the future, the Meade plant at Kingsport, Tennessee, may also be a buyer of hardwood chips for pulp.

While technological changes may be expected to develop more potential for hardwood chips in pulp mills located in central and northern Illinois and at Memphis and Chattanooga, in Tennessee, it is doubtful if the economics of the situation will permit them to purchase chips from eastern Kentucky.

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